The Welding Engineer

Reg. U. S. Pat. Office

Founded by L. B. Mackenzie, 1916

APRIL, 1929 VOL. 14, NO. 4

$3.00 per year in U. S. 608 S. Dearborn St., Chicago, Ill. $4.00 per year abroad

STRONG WELDS *in Copper*

STRONG welds can now be made in copper. Studies in Union Carbide and Carbon Research Laboratories disclosed the cause of low strength in copper welds. Procedure Controls furnishing a solution to the problem were developed. These Procedure Controls are available as a part of Linde Process Service.

Pioneer Manufacturers of Everything for

OXWELDING *and* CUTTING

LINDE OXYGEN
The Linde Air Products Company

Prest-O-Lite
Dissolved Acetylene
The Prest-O-Lite Company, Inc.

Oxweld
Apparatus and Supplies
Oxweld Acetylene Company

UNION CARBIDE
Union Carbide Sales Company

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New York, N. Y.

UCC

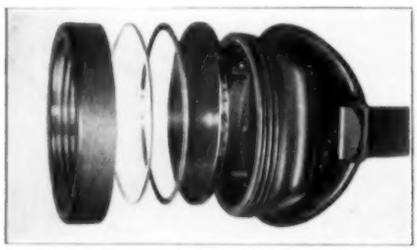
Offices in
Principal Cities
Throughout the Country

64 Linde Plants—45 Prest-O-Lite Plants—154 Oxygen Warehouse Stocks—138 Acetylene Warehouse Stocks—38 Apparatus Warehouse Stocks—235 Carbide Warehouse Stocks

Published monthly by the Welding Engineer Publishing Co. Entered as second class matter Jan. 20, 1916, at the Post Office at Chicago, Ill., under the Act of March 3, 1879.

A New Welding Goggle . .

Ventilation—design. In each eyecup vents located at nasal and temporal sides. Full air circulation — yet all openings completely closed to light.



Cleanliness. Lens assembly quickly dismantled for cleaning and replacement of lenses.

Adjusting. A chain bridge permits adjustment to any face, providing a snug comfortable fit. A twist of the fingers adjusts the bridge.

. . . complete protection from sparks and foreign particles

. . . . elimination of all rays of injurious invisible light

Providing the modern welder with greater protection and greater comfort—comes the new Duralite Welding Goggle. It is lighter in weight—easier to keep clean, and more durable.

Study the ventilating design. Two vents, actually designed for intake and outlet, bring cool air to the face. Now notice the way these vents are wide open for air—yet completely closed to light by an inside baffle plate on the nasal side and an outside louver on the temporal side of each eyecup.

Not only in design, but also in materials, Duralite excels. It is strong, non-inflammable, a non-conductor of heat—will not warp or get out of shape. The new A O Noviweld lenses, giving 99.9% protection against infra-red and ultra-violet, are regularly supplied with Duralite Welding Goggles.

Welders actually feel the comfort of Duralite improvements. Duralite is the result of a real step forward in goggle design—it will quickly achieve all the popularity that has always been enjoyed by American Optical Company goggles.

Prices: Duralite Welding Goggle, per pair, $2.50; in quantities 150 or more, $2.25 per pair.

American Optical Company

Safety Division

NEW YORK ST. LOUIS SAN FRANCISCO CHICAGO KANSAS CITY ATLANTA

Portable Welding and Cutting Outfits

The new Airco-Davis-Bournonville style 8800 Welding Torch, with new styles 8201 Oxygen Regulator and 8202 Acetylene Regulator, are shown with the 12-inch wheel truck for shop use.

The new style 8006 Cutting Torch, with new regulators style 8200 for Oxygen and 8202 for Acetylene, are included in the outfit on the 30-inch wheel truck, which is preferred for field use.

Write to nearest district office, listed below, for details.

AIR REDUCTION SALES COMPANY

Manufacturers and distributors of Airco Oxygen, Airco Acetylene, Airco National Carbide Airco-Davis-Bournonville Welding and Cutting Apparatus and Welding Supplies

Baltimore
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Birmingham
Boston
Buffalo
Charlotte, N. C.
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Dayton
Detroit
Emeryville, Calif.
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DAVIS BOURNONVILLE

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Minneapolis
New Orleans
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Philadelphia
Pittsburgh
Richmond
Seattle
St. Louis
Wheeling

81 Plants

Home Office: 342 Madison Ave., New York City, N. Y.

115 Warehouses

TOUGH, LASTING WELDS WITH
CHASE WELDING RODS

You can *depend* on Chase Welding Rods to give you strong, sound welds always. You'll find it always the same uniform high quality.

Chase Welding Rods—in Brass, Manganese, and Chāmet Bronze*—have all the properties you demand in a good welding metal. Strong and close-grained . . . melts easily, flows freely . . . absence of porosity eliminates sputtering and explosions. Look for the name Chase indelibly stamped on every length of genuine Chase Welding Rod—it is your guarantee of satisfaction.

CHASE

CHASE WELDING RODS

Chase Chāmet Bronze Welding Rod
Chase Manganese Welding Rod
Chase Brass Welding Rod

*Chase Chāmet Bronze Welding Rod is made from our own particular mixture of Bronze, which we have named Chāmet to distinguish it from ordinary kinds of Bronze. Details of tensile strength, elasticity and machining properties gladly mailed upon request.

CHASE

The mark that identifies good brass and copper products.

CHASE BRASS & COPPER CO.
— INCORPORATED —

Home Office • • Waterbury, Connecticut

And prompt deliveries always from the nearest of our thirteen Warehouses in New York • Boston • Newark • Philadelphia • Baltimore • Cincinnati • Cleveland • Detroit • Chicago • St. Louis • New Orleans • Los Angeles • San Francisco. (Also Branch Offices in Rochester, Pittsburgh and Dallas).

The Welding Engineer

Founded by L. B. Mackenzie, 1916

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Economy and Confidence

"BOTH in social and economic progress the creative force of advertising has been tremendous. Perhaps no other single factor has contributed more to our modern industrial process of mass production at lowered unit cost. For advertising has found that mass market for the use of the products of industry geared to high productive capacity."

"Furthermore, advertising has proved a potent force in the new alignment of business standards and practices and in a proper valuation of right relations between business and its public. Business conducted in the broad revealing light of publicity simply can't get away with crookedness. A business which advertises consistently gives hostages to fair play and must redeem them. This is most beneficial. It assures at once better goods and better service."

"One still hears, occasionally, the voice of the dissenter, charging advertising with wastefulness. That complaint which, by the way, is similar to those one hears directed against every other line of human endeavor, rarely, if ever, comes from those in business who understand and work with advertising. The charge of wastefulness is true in regard to only a part—a very small part of modern advertising. A business man who thinks advertising is a magic formula is likely to waste his money. But I am convinced that most of the advertising of today is sincere, informative service which, upon the whole, has the appreciation and confidence of the buying public. It is mass selling, in tune with the mass production of today."

From an address on "The Public Responsibilities of Business," by William Butterworth, President of the Chamber of Commerce of the United States.

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Last Advertising forms close at 8:00 a. m. on the 12th. To show proof for correction copy must be received at an earlier date and allowances should be made for delay to mails. All copy should be in by the 12th of the month at the latest.

The Welding Engineer does not publish in its news or advertising columns any matter that deals with or refers to either personal or legal controversies.

Authorized Representatives

CLEVELAND—R. K. Randall, 2094 E. 19th St.
DENVER—A. G. Odell, Public Opportunity School.
GREAT BRITAIN—Capt. D. Richardson, 26 Winterbrook Road, Herne Hill, London.
AUSTRALIA AND NEW ZEALAND—R. Hill, Matlock House, Davenport, Auckland, New Zealand.
SOUTH AFRICA—J. W. Arnison, 35a Victoria Ave., Benoni, Transvaal, South Africa.

Buyers' Index

Readers of The Welding Engineer will find this index to contain the most accurate information obtainable relating to welding apparatus and supplies. The advertising section includes the principal manufacturers of the United States.

ACETYLENE (Compressed in Cylinders)
Air Reduction Sales Co.
Commercial Acetylene Supply Co.
International Oxygen Co.
Prest-O-Lite Co.
Superior Oxy-Acetylene Co.

ACETYLENE CYLINDERS
Pressed Steel Tank Co.

AIR LIQUEFACTION OXYGEN PRODUCING PLANTS
Keith Dunham Company
Heylandt Sales Co.

ALUMINO-THERMIC WELDING
Metal & Thermit Corporation

ALUMINUM SOLDER
Crown Aluminum Solder Co.
Reynolds Metals Co.

ANNEALING FURNACES
General Electric Co.
Westinghouse Elec. & Mfg. Co

APRONS (Asbestos)
Ideal Face Shield Co.

ASBESTOS INSULATED WIRE AND CABLE
Central Steel & Wire Co.

BLOW PIPES
See "Torches."

BOOKS
The Welding Engineer Pub. Co.
General Electric Co.
Lincoln Electric Co.
Linde Air Products Co.
Electric Arc Cutting & Welding Co
Larry Sherman & Co.

BRAZING OUTFITS
Air Reduction Sales Co.
Bastian-Blessing Co.
Craftsweld Equipment Co.
Imperial Brass Mfg. Co.
International Oxygen Co.
K-G Welding & Cutting Co.
Alexander Milburn Co.
Modern Engineering Co.
Oxweld Acetylene Co.
Superior Oxy-Acetylene Co.
Torchweld Equipment Co.
Victor Oxy-Acetylene Equipment Co.
Williams & Co.

BRONZE FILLER RODS
American Brass Co.
Central Steel & Wire Co.
Chase Brass and Copper Co., Inc.
Mueller Brass Co.
Oxweld Acetylene Co.
Superior Oxy-Acetylene Co.
Steel Sales Corp.

BUFFERS
Biax Flexible Shaft Co.
R. G. Haskins Co.
N. A. Strand & Co.

BUTT WELDERS
See "Electric Resistance Welders"

CABLE (Arc Welding)
Allan Mfg. & Welding Co.
Central Steel & Wire Co.
Electric Arc Cutting & Welding Co
General Electric Co.
Gibb Welding Machines Co.
C. H. Hollup Corp.
Lincoln Electric Co.
Quasi-Arc Weldtrode Co.
Westinghouse Elec. & Mfg. Co
Wilson Welder & Metals Co.

CARBIDE
Air Reduction Sales Co.
National Carbide Co.
Shawinigan Products Corp.
Superior Oxy-Acetylene Co.
Union Carbide Sales Co.

CARBON (Blocks, Paste, Electrodes, etc.)
Air Reduction Sales Co.
Central Steel & Wire Co.
Electric Arc Cutting & Welding Co
National Carbon Co.
Oxweld Acetylene Co.

CARBON BURNING EQUIPMENT
Air Reduction Sales Co.
Bastian-Blessing Co.
Craftsweld Equipment Co.
Imperial Brass Mfg. Co.
International Oxygen Co.
K-G Welding & Cutting Co.
Milburn, Alexander Co.
Modern Engineering Co.
Oxweld Acetylene Co.
Superior Oxy-Acetylene Co.
Torchweld Equipment Co.
Victor Oxy-Acetylene Equipment Co.

CAST IRON SOLDER
Crown Aluminum Solder Co.
Superior Oxy-Acetylene Co.
Weldene Corporation

CAUSTIC POTASH
Innis, Speiden & Company

CUTTING ELECTRODES (Electric Arc)
Allan Mfg. & Welding Co.
Electric Arc Cutting & Welding Co.
General Electric Co.
Lincoln Electric Co.
National Carbon Co.
Westinghouse Elec. & Mfg. Co.
Wilson Welder & Metals Co.

CYLINDERS (Acetylene)
Pressed Steel Tank Co.

CYLINDERS (Oxygen, Hydrogen)
Chas. L. Gulick.
Wm. Wharton, Jr. Co.
Harrisburg Pipe & Pipe Bending Co.

DRILLS, PORTABLE ELECTRIC
Biax Flexible Shaft Co.
R. G. Haskins Co.
Stoody Company
N. A. Strand & Co.

ELECTRIC ARC WELDING OUTFITS
Allan Mfg. & Welding Co.
Burke Electric Co.
Chicago Steel & Wire Co.
Electric Arc Cutting & Welding Co.
Electric Welding Machine Co.
Fusion Welding Corporation
General Electric Co.
Goodman Electric Machinery Co.
Gibb Welding Machines Co.
Hobart Bros. Co.
C. H. Hollup Corp.
Lincoln Electric Co.
E. A. Lundy Co.
Northwestern Mfg. Co.
Owen Electric Mfg. Co.
Quasi-Arc Incorporated
Stoody Co.
Superior Oxy-Acetylene Co.
Westinghouse Elec. & Mfg. Co.
Williams & Co.
Wilson Welder & Metals Co.

ELECTRIC RESISTANCE WELDERS
Federal Machine & Welder Co.
General Electric Co.
Gibb Welding Machines Co.
Goodman Electric Machinery Co.

ELECTRODES (Carbon Arc Welding)
See "Cutting Electrodes"

ELECTRODES (Metallic Arc Welding)
American Steel & Wire Co.
Atlas Foundry Co.
Central Steel & Wire Co.
Chicago Steel & Wire Co.
Electric Arc Cutting & Welding Co
Fusion Welding Corporation
General Electric Co.
Gibb Welding Machines Co.
E. D. Giberson & Co.
C. H. Hollup Corporation
Koro Corporation
Lincoln Electric Co.
Page Steel & Wire Co.
Quasi-Arc Incorporated
Reid-Avery Co.
Roebling, John A., Sons Co.
Seneca Wire Mfg. Co.
Standard Steel & Wire Co.
Steel Sales Corp.
Stoody Company
Taylor-Wharton Iron & Steel Co.
Wickwire Spencer Steel Corp.
Williams & Co.
Wilson Welder & Metals Co.

ELECTRODE HOLDERS
Allan Mfg. & Welding Co.
Burke Electric Co.
Chicago Steel & Wire Co.
Electric Welding Machine Co.
Fibre-Metal Products Co.
Fusion Welding Corporation
General Electric Co.
Gibb Welding Machines Co.
C. H. Hollup Corp.
Koro Corporation.
Lincoln Electric Co.
Northwestern Mfg. Co.
Owen Electric Mfg. Co.
Stoody Co.
Superior Oxy-Acetylene Co.
Westinghouse Elec. & Mfg. Co.
Williams & Co.
Wilson Welder & Metals Co.

ELECTRODE TIPS (Resistance Welding)
Elkon, Inc.

ELECTROLYTIC OXYGEN AND HYDROGEN GENERATING EQUIPMENT
International Oxygen Co.

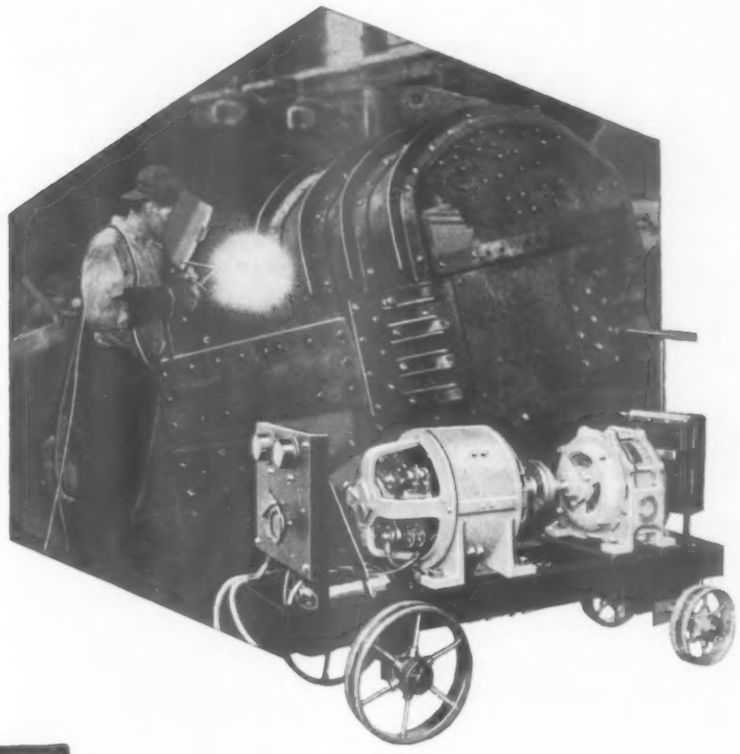
FACE SHIELDS (Arc Welding)
Allan Mfg. Co. & Welding Co.
American Optical Co.
Burke Electric Co.
Central Steel & Wire Co.
Chicago Eye Shield Co.
Electric Arc Cutting & Welding Co.
Fibre-Metal Products Co.
General Electric Co.
Gibb Welding Machines Co.
C. H. Hollup Corp.
Ideal Face Shield Co.
Lincoln Electric Co.
Northwestern Mfg. Co.
Owen Electric Mfg. Co.
Quasi-Arc Incorporated
Stoody Company
Superior Oxy-Acetylene Co.
Westinghouse Elec. & Mfg. Co.
Williams & Co.
Wilson Welder & Metals Co.
Willson Products, Inc.

FILLER RODS
Air Reduction Sales Co.
American Brass Co.
American Steel & Wire Co.
Atlas Foundry Co.
Central Steel & Wire Co.
Craftsweld Equipment Co.
Fusion Welding Corporation
E. D. Giberson & Co.
C. H. Hollup Corp.
Imperial Brass Mfg. Co.
Mueller Brass Co.
Koro Corporation
Oxweld Acetylene Co.
Page Steel & Wire Co.
Reid-Avery Co.
Roebling, John A., Sons Co.
Seneca Wire Mfg. Co.
St. Paul Welding & Mfg. Co.
Standard Steel & Wire Co.
Steel Sales Corp.
Stoody Co.
Superior Oxy-Acetylene Co.
Taylor-Wharton Iron & Steel Co.
Torchweld Equipment Co.
Wickwire Spencer Steel Corp.
Weldit Acetylene Co.
Williams & Co.

FIREPROOF PLASTIC MATERIAL
Air Reduction Sales Co.
National Carbon Co.

FLUE WELDERS (Electric)
General Electric Co.

FLUXES
Air Reduction Sales Co.
Anti-Borax Compound Co.
Metal & Thermit Corp.
Central Steel & Wire Co.
Modern Engineering Co.
Oxweld Acetylene Co.
St. Paul Welding & Mfg. Co.



They *tried* 4 *makes* of Welding Machines —then *Standardized* on WILSON

IN the shop where the accompanying picture was taken A. C. Nielsen Company made an intensive study of welding operations in the repair of locomotives, railway cars, cranes, and other contractors' equipment.

Nielsen reports that, in searching for welding equipment that would meet their extremely varied and highly exacting needs, this shop experimented with four different makes of welding machines. And, although each of the first three machines gave satisfactory service in certain kinds of work, all three makes proved incapable of rapid arc adjustment as they were changed from job to job, and thus caused a considerable loss.

Then a Model S Wilson Welding Machine was purchased. Immediately it demonstrated quicker *adaptability*, closer *control*, greater *portability*, and far greater *strength* in welds than the machines previously used. Its superiority was also reflected in *lower power cost, lower total upkeep, and a tremendous saving in time*. As a result, the company *standardized* on *Wilson*, and today, all their welding is done *exclusively* with Wilson Machines.

Regardless of what your industry is, Wilson—with its long and varied experience, with its great accumulation of welding information—can assist you in solving your welding problems.

WILSON WELDER & METALS CO. INC.
20 Wilson Building, Hoboken, N. J.

WILSON

WELDING MACHINES AND WELDING WIRE

In the repair shop referred to above Wilson "Color-tipt" Welding Wire has been used almost *exclusively* for the last five years. As a result of its long experience, this company points out that one of the outstanding advantages of

Trade Mark Reg. U. S. Pat. Off.

Wilson Wire is that the *right* grade (analysis) can be selected for the *particular metal* being welded. A sample of the *right* grade of Wilson Wire for the metal *you* are welding will be sent gladly upon request—no obligation.

Superior Oxy-Acetylene Co.
Torchweld Equipment Co.
Weldit Acetylene Co.

GAS SAVING DEVICES
Weldit Acetylene Co.

GLOVES (Asbestos)
Ideal Face Shield Co.

GAUGES
Moto Meter Co.
National Gauge & Equipment Co.

GENERATORS (Acetylene)
Air Reduction Sales Co.
Bastian-Blessing Co.
Craftsweld Equipment Co.
Imperial Brass Mfg. Co.
Milburn, Alexander Co.
Modern Engineering Co.
Oxweld Acetylene Co.

GLOVES
Morrison-Ricker Mfg. Co.

GOGGLES
American Optical Co.
Chicago Eye Shield Co.
Ideal Face Shield Co.
Willson Products, Inc.

GRINDERS (Portable Electric)
Biax Flexible Shaft Co.
R. G. Haskins Co.
Stoody Company.
N. A. Strand & Co.

HELMETS (Arc Welding)
Allan Mfg. & Welding Co.
American Optical Co.
Burke Electric Co.
Central Steel & Wire Co.
Chicago Eye Shield Co.
Electric Arc Cutting & Welding Co.
Fibre-Metal Products Co.
Fusion Welding Corporation
General Electric Co.
Gibb Welding Machines Co.
C. H. Hollup Corp.
Ideal Face Shield Co.
Lincoln Electric Co.
Northwestern Mfg. Co.
Owen Electric Mfg. Co.
Quasi-Arc Incorporated
Superior Oxy-Acetylene Co.
Westinghouse Elec. & Mfg. Co.
Williams & Co.
Wilson Welder & Metals Co.
Willson Products, Inc.

HYDROGEN
Gas Products Association
International Oxygen Co.

HYDROGEN GENERATING PLANTS
International Oxygen Co.

LEAD WELDING UNITS
Air Reduction Sales Co.
Bastian-Blessing Co.
Craftsweld Equipment Co.
Imperial Brass Mfg. Co.
International Oxygen Co.
K-G Welding & Cutting Co.
Modern Engineering Co.
Milburn, Alexander, Co.
Oxweld Acetylene Co.
Superior Oxy-Acetylene Co.
Torchweld Equipment Co.
Victor Oxy-Acetylene Equipment Co.
Weldit Acetylene Co.

LIGHTERS (For Gas Torches)
Air Reduction Sales Co.
Bastian-Blessing Co.
Imperial Brass Mfg. Co.
International Oxygen Co.
K-G Welding & Cutting Co.
Michigan Matchless Utilities Co.
Milburn, Alexander, Co.
Modern Engineering Co.
Oxweld Acetylene Co.
Safety Gas Lighter Co.
Shoot-a-Lite Corporation.
Superior Oxy-Acetylene Co.
Torchweld Equipment Co.

MANIFOLDS
Air Reduction Sales Co.
Bastian-Blessing Co.
Craftsweld Equipment Co.
Imperial Brass Mfg. Co.
International Oxygen Co.
K-G Welding & Cutting Co.
Milburn, Alexander, Co.
Modern Engineering Co.
Oxweld Acetylene Co.
Superior Oxy-Acetylene Co.
Torchweld Equipment Co.
Victor Oxy-Acetylene Equipment Co.

MECHANICALLY OPERATED CUTTING AND WELDING TORCHES
Air Reduction Sales Co.
Oxweld Acetylene Co.
Torchweld Equipment Co.

MOLDING MATERIAL
See "Fire Proof Plastic Material"

MONEL METAL RODS AND ELECTRODE
Central Steel & Wire Co.
Wilson Welder & Metals Co.

NEEDLE VALVES
Air Reduction Sales Co.
Bastian-Blessing Co.
Imperial Brass Mfg. Co.
International Oxygen Co.
K-G Welding & Cutting Co.
Milburn, Alexander, Co.
Modern Engineering Co.
Oxweld Acetylene Co.
Torchweld Equipment Co.
Victor Oxy-Acetylene Equipment Co.

NICHROME WELDING WIRE
Driver-Harris Co.

NITROGEN
Air Reduction Sales Co.
Gas Products Association
Linde Air Products Co.
International Oxygen Co.

OXYGEN
Air Reduction Sales Co.
Gas Products Association
International Oxygen Co .
Linde Air Products Co.
Superior Oxy-Acetylene Co.

PIPE BENDS AND COILS
Harrisburgh Pipe and Pipe Bending Co.

PORTABLE ARC WELDING OUTFITS (Mounted on Trucks)
General Electric Company
Chicago Steel & Wire Co.
Electric Arc Cutting & Welding Co.
Hobart Bros. Co.
Lincoln Electric Co.
Northwestern Mfg. Co.
Wilson Welder & Metals Co.
Westinghouse Electric & Mfg. Co.
Shrader Electric Company

PREHEATING DEVICES AND OVENS
Imperial Brass Mfg. Co.
Metal & Thermit Corp.
St. Paul Welding & Mfg. Co.

REAMERS (Portable Electric)
R. G. Haskins Co.
N. A. Strand & Co.

REGULATORS
Air Reduction Sales Co.
Bastian-Blessing Co.
Craftsweld Equipment Co.
Fusion Welding Corporation
Imperial Brass Mfg. Co.
International Oxygen Co.
K-G Welding & Cutting Co.
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Modern Engineering Co.
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St. Paul Welding & Mfg. Co.
Stoody Company
Superior Oxy-Acetylene Co.
Torchweld Equipment Co.
Victor Oxy-Acetylene Equipment Co.
Weldit Acetylene Co.
Williams & Co.

SEAM WELDERS
See "Electric Resistance Welders"

SILVER SOLDER
Handy & Harman

SWEDISH IRON WELDING WIRE
Bissett Steel Co.

SPOT WELDERS
See "Electric Resistance Welders"

TANK CONNECTIONS
Air Reduction Sales Co.
Bastian-Blessing Co.
Imperial Brass Mfg. Co.
International Oxygen Co.
K-G Welding & Cutting Co.
Milburn, Alexander, Co.
Oxweld Acetylene Co.
Superior Oxy-Acetylene Co.
Torchweld Equipment Co.

THERMIT WELDING
Metal & Thermit Corp.

TORCHES (Welding and Cutting)
Air Reduction Sales Co.
Craftsweld Equipment Co.
Bastian-Blessing Co.
Fusion Welding Corporation
Imperial Brass Mfg. Co.
International Oxygen Co.
K-G Welding & Cutting Co.
Milburn, Alexander, Co.
Modern Engineering Co.
Oxweld Acetylene Co.
St. Paul Welding & Mfg. Co.
Stoody Company
Superior Oxy-Acetylene Co.
Torchweld Equipment Co.
Victor Oxy-Acetylene Equipment Co.
Weldit Acetylene Co.
Williams & Co.

TRUCKS (Cylinder)
Air Reduction Sales Co.
Imperial Brass Mfg. Co.
International Oxygen Co.
Superior Oxy-Acetylene Co.
Torchweld Equipment Co.

VALVES
Air Reduction Sales Co.
Bastian-Blessing Co.
International Oxygen Co.

WELDING COMPOUND (for Shape Welding)
Air Reduction Sales Co.
Modern Engineering Co.
National Carbon Co.
Superior Oxy-Acetylene Co.

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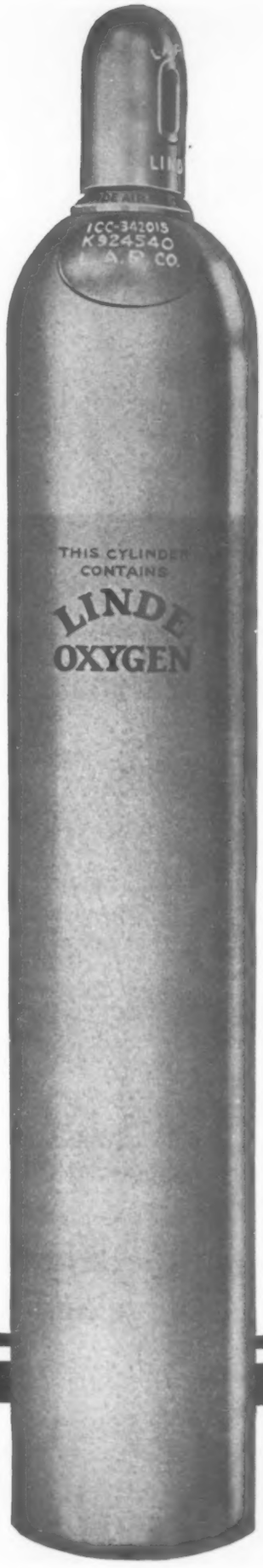

LINDE OXYGEN

Available Anywhere

LINDE Oxygen is a quality product—standard for more than two decades. Its economical application to your particular requirements is assured by the operative assistance and engineering counsel of Linde Process Service.

57 Linde Plants and 99 Linde Warehouses are located in key cities throughout the country. This vast production and distribution system makes Linde Oxygen available anywhere at little or no transportation cost.

THE LINDE AIR PRODUCTS CO.

Unit of Union Carbide and Carbon Corporation

57 Plants UCC 99 Warehouses

General Offices: Carbide and Carbon Building

30 East 42nd Street, New York

"Here, Lad—

We need some new welding machines. I listened to you last time and bought Lincolns. Then my old electrical friend was sore because I didn't buy his.

Let's compromise this time and get his make—you know he takes his welder quite seriously."

"Yes, Pop—

But I don't. The safe way to settle our difference of opinion is not by compromise—but by arbitration.

To arbitrate a difference requires a third person. If you'll put an experienced welder operator on as arbiter—that ought to make it safe for both of us.

And naturally, I feel that the operator would settle the discussion in favor of a Lincoln 'Stable-Arc' because he is the man who will profit from the 7 points at the left.

But the fact that your friend takes his welder seriously is beside the question. It simply proves his lack of humor."

The Lincoln "Stable-Arc" Welder

— welds easier
— makes better welds
— permits greater output

because of the steady uniform arc throughout entire welding range, which is the result of:

Variable voltage design
Laminated magnetic circuit
Separately-excited generator field
Double control of welding heat
All steel construction

No other welder has all these features.

The Lincoln Electric Co.,
Dept. No. 27-4, Cleveland, Ohio

W-80

LINCOLN "Stable-Arc" WELDER

You Would Expect It to Cost More—But It Doesn't

ALTHOUGH **SWEDOX** wire represents close supervision and careful checking of analysis, rigid inspection before it is placed in stock as welding wire, and a study of welding wire requirements which dates back to the first days when any attention was paid to the quality of filler material, SWEDOX does not increase your welding costs. This is not because it is a "cheap" line, but because SWEDOX has welding qualities which reduce waste effort and weld failures to a minimum. Welders who started using SWEDOX fifteen years ago have found it profitable to use SWEDOX ever since.

There is a SWEDOX Wire for every type of welding. Let us help you select the one best adapted to your work.

Central Steel & Wire Company

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Lafayette 8500

DAYTON, OHIO
East Monument Ave.
Extended
East 150

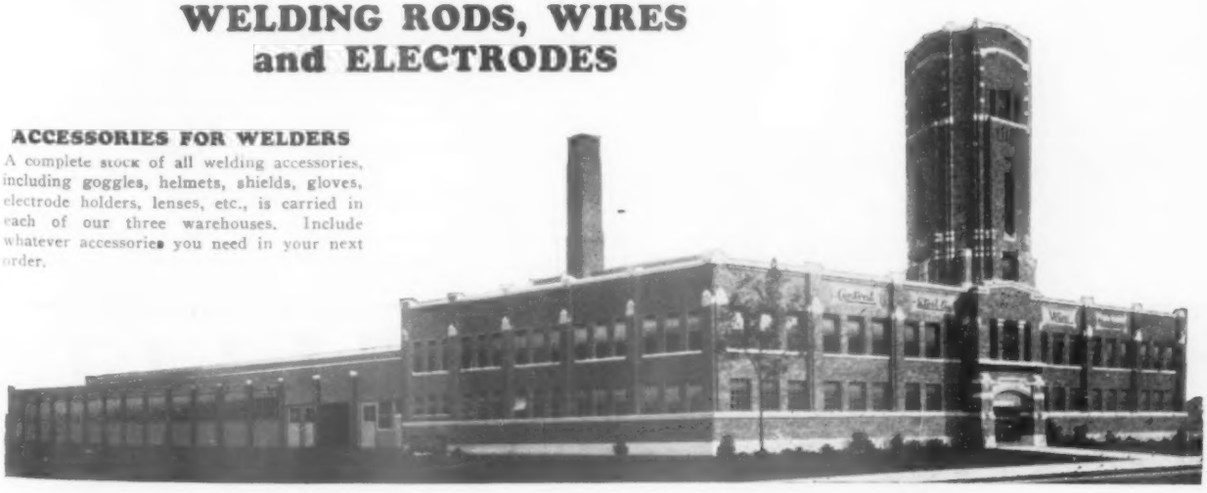
DETROIT, MICH.
5001 Bellevue Ave.
Whittier 6780

SWEDOX

WELDING RODS, WIRES and ELECTRODES

ACCESSORIES FOR WELDERS

A complete stock of all welding accessories, including goggles, helmets, shields, gloves, electrode holders, lenses, etc., is carried in each of our three warehouses. Include whatever accessories you need in your next order.



Main Warehouses and General Offices, Central Steel & Wire Co., Chicago

This photograph shows the location of Haynes Stellite welding rod. A band approximately ½" wide and 3/64" thick is applied on the top of the cutting edge. The top and bottom sides of the point are also coated with Haynes Stellite welding rod 2" from the extreme point and ⅛" thick.

Long wearing plow shares

HAYNES STELLITED plow shares wear from four to five times as long as regular steel shares and cost less than twice as much.

By the use of the Stelliting process (the application of Haynes Stellite in the form of welding rod to wearing and cutting surfaces) farmers can now procure plow shares that will reduce their cost per acre.

Farm equipment dealers and welding shops—Develop this business with the farmers in your locality. You can apply Haynes Stellite to new and worn solid or soft center steel plow shares in your own shops and render a real service to your customers, with real profit to yourselves.

Write for our pamphlet describing in detail how Haynes Stellite is applied to this important part of the farmer's equipment.

HAYNES STELLITE COMPANY

Unit of Union Carbide and Carbon Corporation

UCC

DISTRICT SALES OFFICES

Chicago—1949 Peoples Gas Building
Cleveland—628 Keith Building
Detroit—4-240 General Motors Building
Houston—6119 Harrisburg Building
Los Angeles—1310 Santee Street
New York—30 East 42nd Street
San Francisco—114 Sansome Street
Tulsa—Exchange National Bank Building

General Offices—Kokomo, Indiana

Haynes Stellite welding rod is also available from any of the 28 District Sales Offices of Oxweld Acetylene Company

Stelliting with

HAYNES STELLITE

The Most Popular ARC WELDER ON THE MARKET

THE MORE YOU ARC WELD THE MORE YOU SAVE

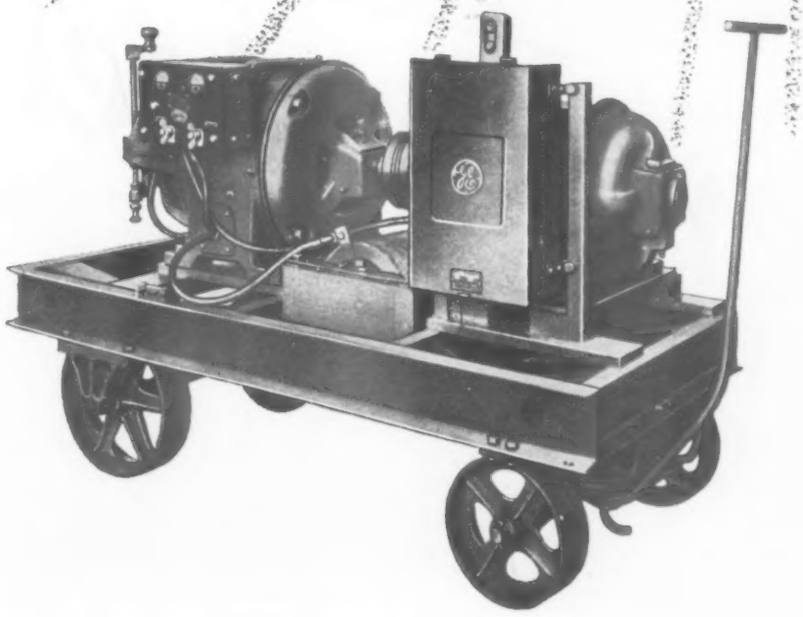
"Type WD" is its name. Introduced less than a year ago, it is now actually outselling every other type of arc welder.

It's the simplest, most substantial, and best-looking set built. Liberal use of high-grade materials, fine workmanship, and good design—inherent in all G-E products—are apparent at a glance. It is a self-excited set—that means no separate exciter to look after.

No other arc welder excels it in speed of welding or deposition of metal. Infinitely small gradations of welding current can be obtained simply by turning a handle. It is extremely easy to operate and will give 24-hour service day after day. And we back our reputation against its ability to meet N.E.M.A. and N.E.L.A. ratings—at any time.

A call to your nearest G-E office will bring you complete information.

TYPE WD



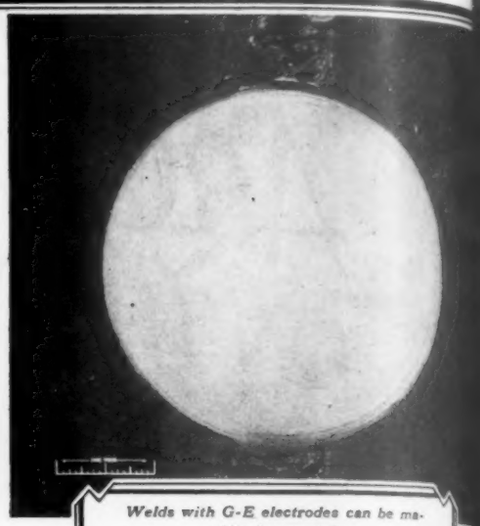
G-E welding electrodes—when used with Type WD arc welders—produce strong, smooth welds at great speed.

530-58

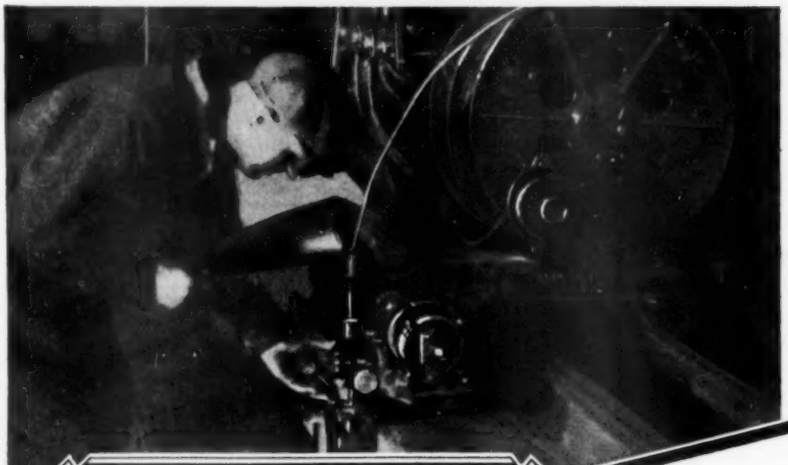
GENERAL ELECTRIC

GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y., SALES OFFICES IN PRINCIPAL CITIES

G-E electrodes produce beads of uniform texture, strength, and lasting qualities



Welds with G-E electrodes can be machined accurately



G-E Type "F" is used with this gigantic automatic arc-welding set

The G-E generators for Conowingo were welded with Type "F"

Wherever steel is

G-E electrodes speed construction as well as repair work

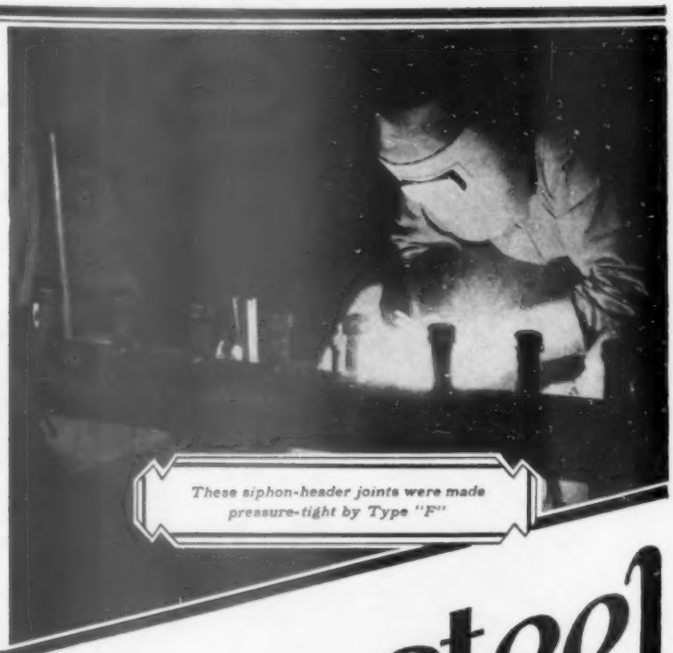
In absolute reliability of operation and overall efficiency, G-E arc welding sets are unequalled. They are available in all sizes, all types—for either hand or automatic operation—for one or more operators.

JOIN US IN THE GENERAL ELECTRIC HOUR, BROADCAST EVERY

GENERAL

MERCHANDISE DEPARTMENT,

These tanks and boiler shells were welded with Type "F"



These siphon-header joints were made pressure-tight by Type "F"

to be joined to steel

TYPE F ELECTRODES

IN factories or repair shops, wherever steel is to be joined to steel, G-E Type "F" has proved itself the logical welding electrode. Experience teaches that a hard and unannealed electrode is best for general work. Type "F" is a clean metallic electrode which, because it is given a special General Electric treatment, is free from annealed scale, making it unnecessary for the operator to work or "puddle out" foreign substances in the electrode.

These features especially commend G-E Type "F" electrode to operators: extreme arc stability, rapidity of deposition, and ease of handling. Its *non-spattering* properties produce smooth, neat welds. All types of welding—flat, vertical, horizontal, and overhead—are equally simple when Type "F" is used.

For prompt service or additional information as to various types of G-E electrodes, get in touch with the G-E Welding Electrode Distributor near you or write to Section E-534, Merchandise Department, General Electric Company, Bridgeport, Connecticut.

550-503

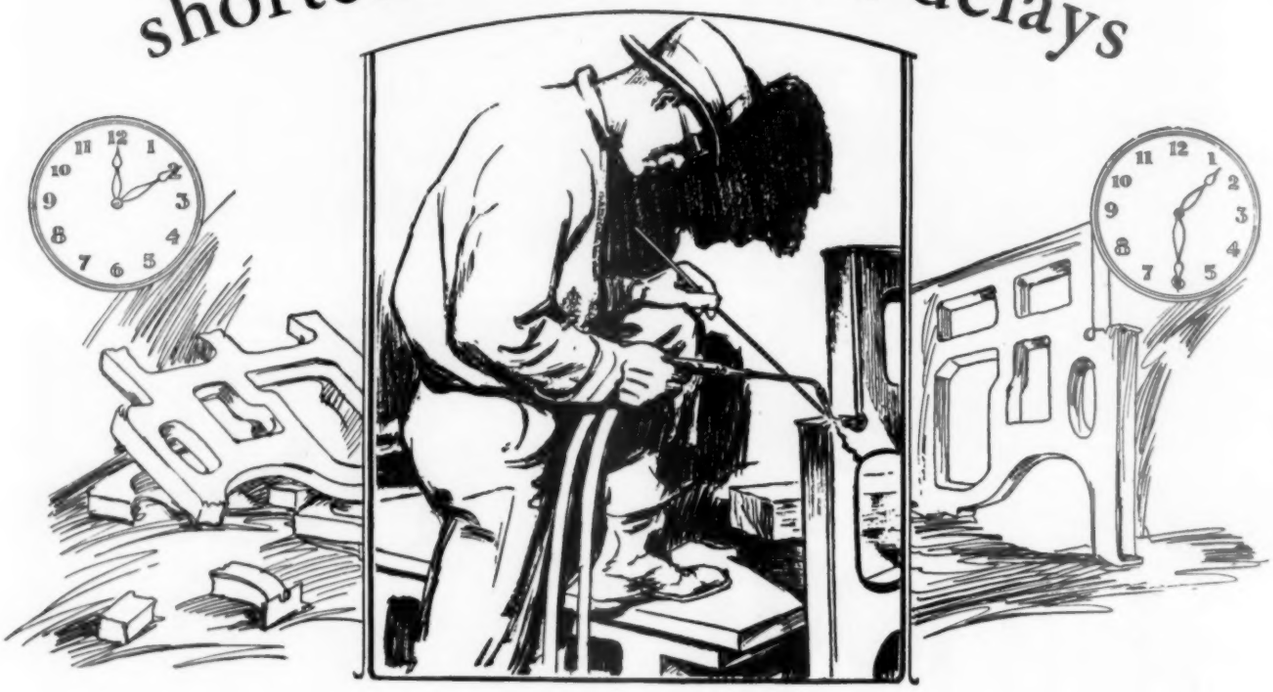
SATURDAY AT 9 P.M., E.S.T., ON A NATION-WIDE N.B.C. CHAIN

ELECTRIC

BRIDGEPORT, CONNECTICUT

PREST-O-WELD

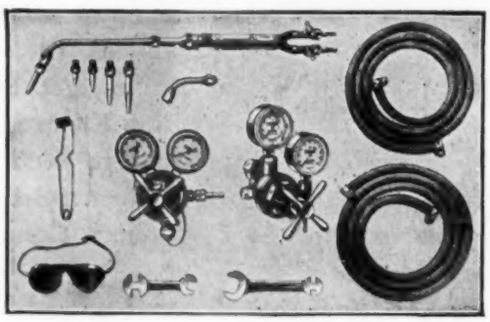
shortens breakdown delays



PREST-O-WELD cutting and welding apparatus is representative of a modern better way of doing things. In the thousands of shops where it is used, long waits for replacement parts have been practically eliminated. Broken and worn parts are quickly welded or built up and returned to service as good as new. It saves both time and money.

Any good mechanic can readily learn to use Prest-O-Weld and with reasonable practice can do any average job within the range of the process. Prest-O-Weld equipment is standard. It is simple, sturdy and dependable. It pays for itself out of savings.

Made by the largest manufacturers of oxy-acetylene apparatus in the world. Sold by jobbers everywhere.



Prest-O-Weld Welding Outfit No. W-101
Price $75.00
Other Utility Outfits as low as $49.50

OXWELD ACETYLENE COMPANY • *Unit of Union Carbide and Carbon Corporation*

UCC

NEW YORK: Carbide and Carbon Building
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You Can Bank on Mueller Welding Bronze — and on Mueller Service

YOU will find that Mueller Welding Bronze Rod will give you the same definite result time after time. It has all the qualities that you would expect to find in a real product. It is strong and close grained . . . It melts easily and flows freely. Absence of porosity eliminates sputtering and explosions.

Mueller Welding Rod is distinguished by the wording "Mueller Welding Bronze" stamped every few inches on the rod itself.

For a special job that must machine easily or take a high finish — or for any job — you can depend on it to give you the results you must have.

When you are in a hurry you can depend upon quick delivery, too.

Mueller Brass Co.
PORT HURON MICHIGAN

THREE GENERATIONS OF BRASS MAKING

"Alterations? — The cost is trifling!

"That's one of the advantages of welded piping."

THE scene above is taken from an educational motion picture film, on the subject of welded piping, produced by the Gas Products Association. The film shows why welding is the modern way of installing piping systems in all types of buildings. It contains information of great value to heating contractors, piping contractors, architects and builders. Arrangements for showing this film to interested groups can be made by corresponding with the office of the Association or any of the members listed below.

Buy at Home From Your Neighbors

ALABAMA
Birmingham—Burdett Oxygen Co.
Birmingham — Standard Gas Products Co. of Alabama.
Mobile—Louisiana Oxygen Co.

ARKANSAS
El Dorado—The Beaird Corporation.
Little Rock—The Beaird Corporation.

DELAWARE
Wilmington—Paschall Oxygen Co.

GEORGIA
Atlanta—Burdett Oxygen Co.

ILLINOIS
Chicago—Burdett Oxygen & Hydrogen Co. of Chicago.
Chicago—Swift and Company.
Elgin—Wisconsin Oxygen-Hydrogen Co.
Freeport — Wisconsin Oxygen-Hydrogen Co.
Peoria—Electrox Co.
Rockford — Wisconsin Oxygen-Hydrogen Co.

INDIANA
Evansville—Kentucky Oxygen-Hydrogen Co.
Indianapolis — Indiana Oxygen Co.
South Bend—Burdett Oxygen-Hydrogen Co. of Chicago.

KENTUCKY
Louisville — Kentucky Oxygen-Hydrogen Co.

LOUISIANA
Monroe—The Beaird Corporation.
New Orleans—Louisiana Oxygen Co.
Shreveport—The Beaird Corporation.

MICHIGAN
Detroit—Burdett Oxygen Co. of Detroit.
Grand Rapids—Grand Rapids Welding Supply Co., Inc.
Kalamazoo — Grand Rapids Welding Supply Co.

MINNESOTA
Minneapolis — Commercial Gas Co.

MISSOURI
Kansas City—Kansas City Oxygen Gas Co.
Kansas City—Ox-Hydrogen Mfg. Co.

NEBRASKA
Omaha—The Balbach Co.

NEW JERSEY
Camden—Paschall Oxygen Co.
Newark—International Oxygen Co.
New Brunswick—International Oxygen Co.
Paterson — International Oxygen Co.
Plainfield—International Oxygen Co.
Trenton — Paschall Oxygen Company.
Trenton—International Oxygen Co.

NEW YORK
Brooklyn — International Oxygen Co.
Long Island City — International Oxygen Co.
New York—International Oxygen Co.

OHIO
Cincinnati—Ohio Valley Oxygen Co.
Cleveland—Burdett Oxygen Co. of Cleveland.
Columbus—Gas Products Co.
Toledo — International Oxygen Co.

OKLAHOMA
Oklahoma City — The Burdett Oxygen Co. of Oklahoma.

PENNSYLVANIA
Allentown — Paschall Oxygen Company.
Lancaster — Paschall Oxygen Company.
Lebanon — Paschall Oxygen Company.
Philadelphia—Paschall Oxygen Co.
Pittsburgh—Burdett Oxygen & Hydrogen Co.
Reading—Paschall Oxygen Company.
Verona—International Oxygen Co.
York—Paschall Oxygen Company.

TENNESSEE
Chattanooga—Burdett Oxygen Co. (of Chattanooga).
Knoxville—Burdett Oxygen Co. (of Chattanooga).
Nashville—Burdett Oxygen Co. (of Chattanooga.)
Nashville — Kentucky Oxygen-Hydrogen Co.

TEXAS
Austin—Capital Battery Co. (Burdett.)
Beaumont—Magnolia Gas Products Company.
Dallas—American Welding Co. (Burdett.)
Ft. Worth—Burdett Oxygen Co. of Texas.
Galveston—Gregory Auto Supply Co. (Magnolia.)
Houston—Magnolia Gas Products Co.
Ranger—Oil Belt Welding Supply Co. (Burdett.)
San Antonio — Magnolia Gas Products Co.
Temple—Russell Transfer Co. (Burdett.)
Waco—McCrary Transfer Co. (Burdett.)
Wichita Falls—Burdett Oxygen Co. of Texas.

WASHINGTON
Spokane—Spokane Oxy-Acetylene Co.

WISCONSIN
Appleton — Universal Oxygen Co.
Beloit—Wisconsin Oxygen-Hydrogen Co.
Fond du Lac—Universal Oxygen Co.
Green Bay—Universal Oxygen Co.
Janesville—Wisconsin Oxygen-Hydrogen Co.
Kenosha — Wisconsin Oxygen-Hydrogen Co.
Lake Geneva—Wisconsin Oxygen-Hydrogen Co.
Madison—Universal Oxygen Co.
Manitowoc—Universal Oxygen Co.
Milwaukee — Universal Oxygen Co.
Oshkosh — Wisconsin Oxygen-Hydrogen Co.
Racine—Wisconsin Oxygen-Hydrogen Co.
Sheboygan—Universal Oxygen Co.

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Honolulu—Hawaiian Gas Products, Ltd.

BOLD FACE TYPE signifies Manufacturing Plants.
LIGHT FACE TYPE indicates warehouses.

Gas Products Association

333 N. Michigan Ave. Chicago, Ill.

First to Advocate High Purity Oxygen

HANDY & HARMAN
FOUNDED 1867
QUALITY SERVICE

Handy Silver Solder

For a Wide Range of Uses

TO meet every type of working condition in soldering, brazing and welding, we supply "Handy" Silver Solders in the form of wire, strips, sheets or filings, in any of the following:

GUARANTEED FORMULAS

Name	Melting Point		Color	Name	Melting Point		Color
"TL" "ATT" "NE"	1600° 1500° 1575°	F	Brass Yellow	"DE" "ET" "ETX"	1370° 1340° 1425°	F	Yellow-white
"NT" "SS" "DT"	1450° 1435° 1445°	F	Pale Yellow	"RT" "BT" "IT"	1325° 1425° 1460°	F	Silver-white

Silver-content of the above solders ranges from 10% to 80%.

Each composition has its definite range of uses; and each form is made for convenience and speed in certain operations.

Metals They Join

Silver	Bronze	Stainless steel
Nickel	Steel	Monel metal
Copper	Extruded brass	Nickel-silver
Brass	Extruded bronze	Silicon Steel

—and other metals and alloys fusing at 1,400° F. or higher.

Accuracy In All Things

62 years' experience in the fabrication of precious metals has given us a degree of accuracy unknown to the base-metal industries. All weights are made by Troy ounce and decimal parts, on scales used for weighing silver, gold, and platinum. All gauges widths and sizes are accurate to the finest fraction. All formulas are guaranteed to be uniform and as dependable as our famous Sterling Silver.

We Co-operate

Our Service Department is skilled in handling soldering and brazing problems. Consult us. Like-as-not we can point out ways of speeding up your production, reducing unit cost and increasing customer satisfaction.

The Handy Book of Silver Solder "W"

Contains much valuable information. Send for your copy.

HANDY & HARMAN

57 William Street, New York, N. Y.

Fulton & Gold Sts., New York, N. Y.

PLANTS: Bridgeport, Conn.

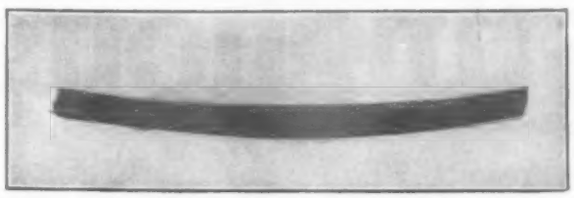
425 Richmond St., Providence, R. I.

25-oz. Coil of Wire ⅛-in. or 18 B. & S. Ga.

1-oz. Coil of Wire ⅛-in. or 18 B. & S. Ga.

1 oz. of Thin Strip in a Brass Can

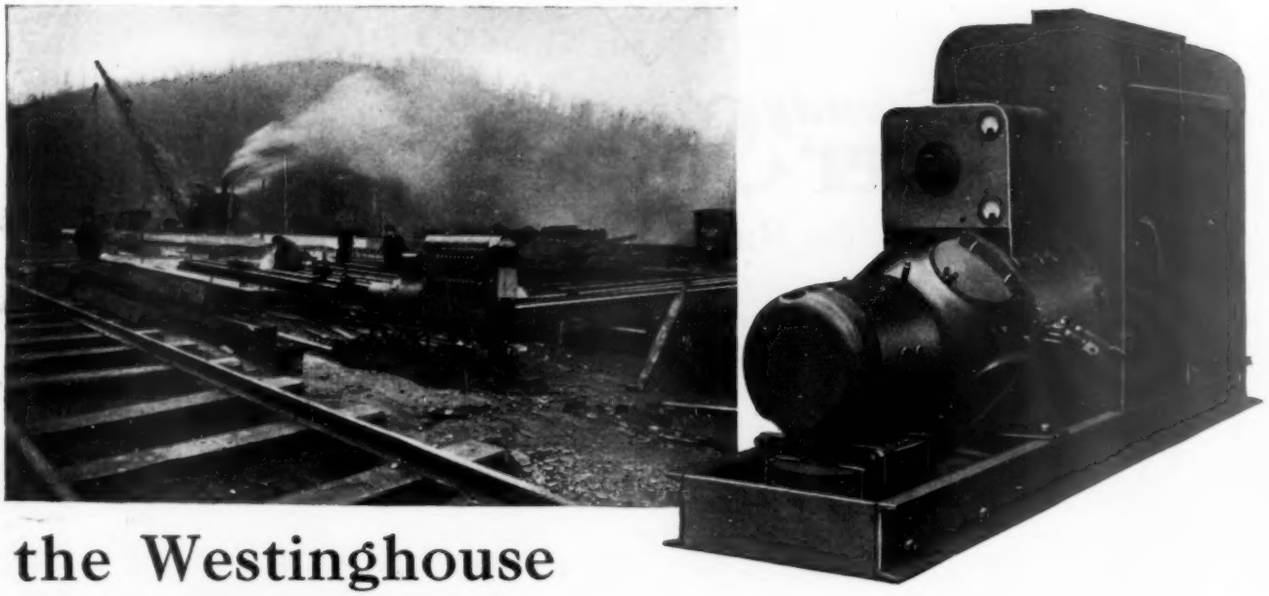
Roll of Sheet, 20 Ga. B. & S., any width



20-in. Strips—⅛ in. Wide—20 B. & S. Ga. Thick

Filed Silver Solder—40-60-80-100-150 Mesh

Built *for the* Field



the Westinghouse Gas Engine Driven Arc Welding Set

(single operator)

THE contractor who operates in the field has an especially high appreciation of good machinery. Even though it be subject to the extremes of severe service conditions, his equipment must perform without fail--it is isolated. He cannot afford shutdowns.

The Westinghouse Gas Engine Driven Arc Welding Set is a self-contained unit--rigid and compact--intended for either portable or stationary service. Protective covers assure its dependable operation under all weather conditions, out in the open. It embodies the best materials, scientifically assembled to fulfill the toughest service requirements of field construction and repair work.

The welding generator produces a steady and penetrating arc which is easy to strike and maintain. Positive control of the current value is obtained by a single dial rheostat. The gas engine operates with remarkable fuel economy and meets the most exacting requirements of starting and close speed regulation. The generator and drive act as a unit to produce fast work and perfect welds. Write for Descriptive Leaflet 20390.

WESTINGHOUSE ELECTRIC & MFG. COMPANY
EAST PITTSBURGH PENNSYLVANIA
SALES OFFICES IN ALL PRINCIPAL CITIES OF THE UNITED STATES AND FOREIGN COUNTRIES

Westinghouse

T 30436

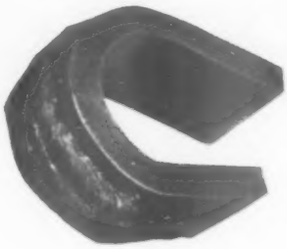
Welders - -

200, 300 and 400-ampere a-c.—d-c. sets
200 and 300-ampere d-c.—d-c. sets
200 and 300-ampere Gas Engine Driven sets
Multiple operator sets and control
Automatic Seam Welder
Arc welding accessories

The New Hollup
LIGHTNING
Electrode

gives

DUCTILITY

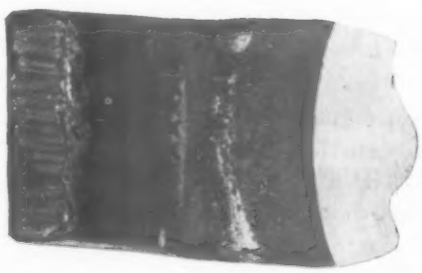


The coating on this latest Hollup wire protects the molten metal in the arc and in the puddle from contact with the atmosphere, resulting in unusual ductility of the weld, as evidenced by the test shown here. Weld bent through 180 degrees without showing a fracture.

PENETRATION

The "Lightning" electrode bears this name because of its remarkable speed. The high voltage this wire will carry—30 to 35 volts—accounts for three advantages: greater welding speed, ease of maintaining a continuous arc, and depth of penetration. Note how the welding heat went through a ¼" plate.

DENSITY



The speed at which this rod works leaves a larger molten section behind, producing a smooth, dense weld without the usual wavy ridges of an arc weld. For accelerating your production welding, at the same time improving the welds, use the Hollup "Lightning" Electrode exclusively.

C. H. HOLLUP CORP.
3333 W. 48th Place, CHICAGO

HOLLUP WELDING PRODUCTS

We Wish to Announce
that
OWEN WELDERS

are manufactured in Fayetteville, North Carolina, only. They are not now and never have been manufactured in Omaha, Nebraska, neither have we an authorized distributor in the Omaha territory. This and other territory is open to reliable distributors.

THE OWEN

will take care of your arc welding jobs with the lowest possible consumption of current and for the smallest investment in equipment and gives a STABILIZED DEEP PENETRATING arc that thoroughly mixes the metallic electrode material with that of the parent metal.

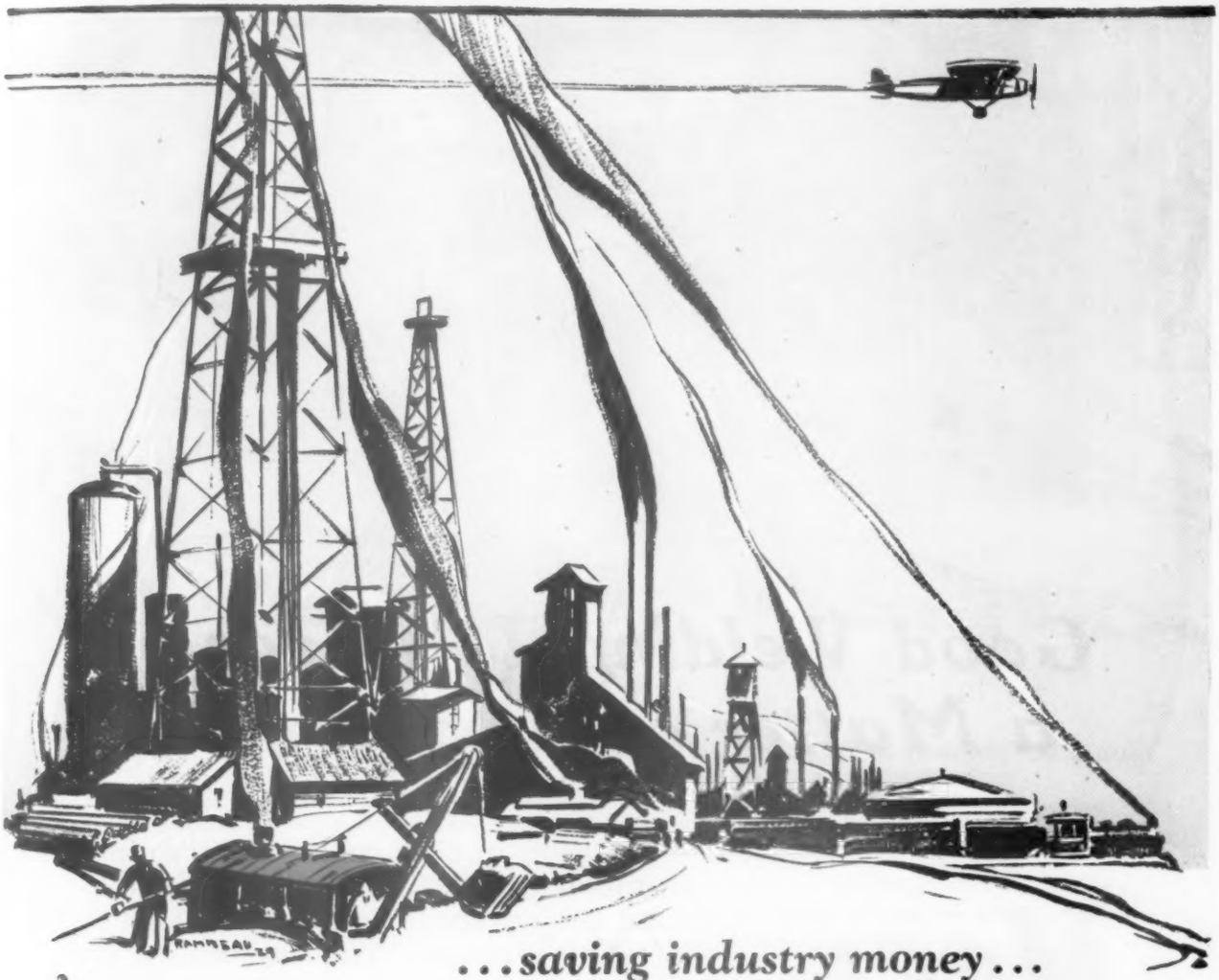
The Owen will soon pay for itself in reclaiming broken and worn parts that are impractical to repair except with the electric arc.

Address all communications to

OWEN ELECTRIC MANUFACTURING COMPANY

Fayetteville, North Carolina

STOODITE AND STOODY ROD



...saving industry money... in time and wear and tear!

THESE two surfacing and welding products have given industry an entirely new concept of dollar-saving economy. They save wear and tear... prolong the life of expensive equipment... *and more,* they save money through their application. ~ STOODITE, the super-hard surfacing metal, has a resistance to abrasion that is almost unbelievable. It is easily welded on with either the electric arc or the acetylene torch...and, once on, it *stays... prevents wear!* ~ STOODY ROD is used wherever unusual stress or continual pounding require a material that will "stand the gaff" without breaking down. ~ Both are easily applied. Both are self-hardening. Both fill a long-felt need in industry, in surprisingly efficient manner.

Write for full information

STOODY COMPANY

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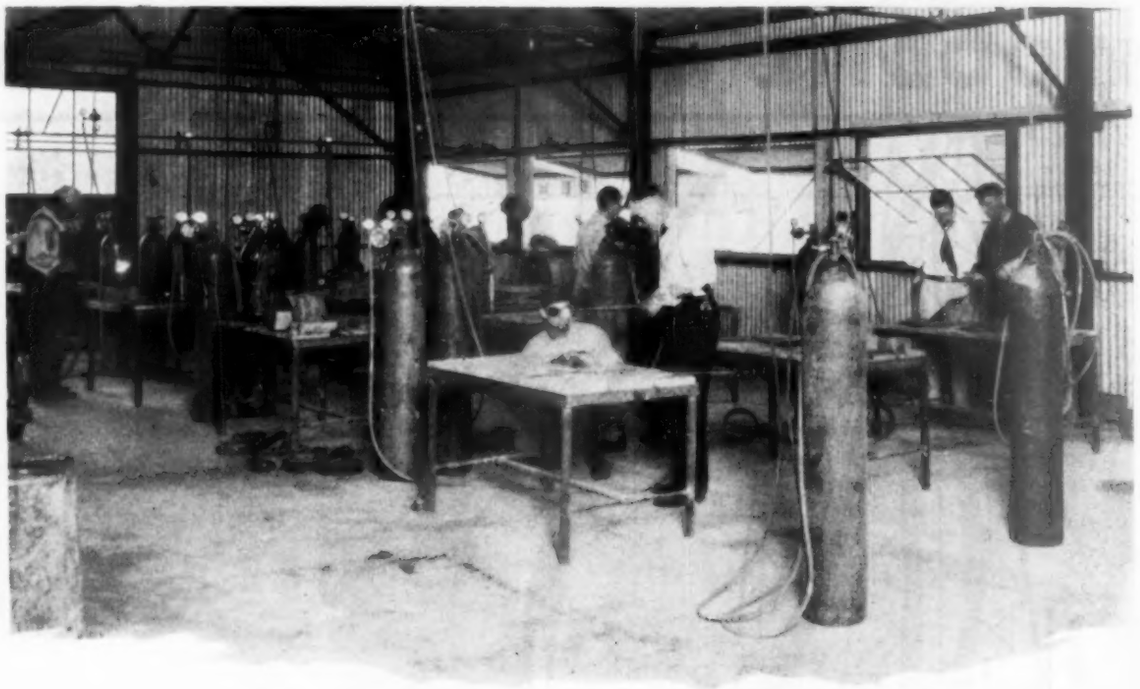

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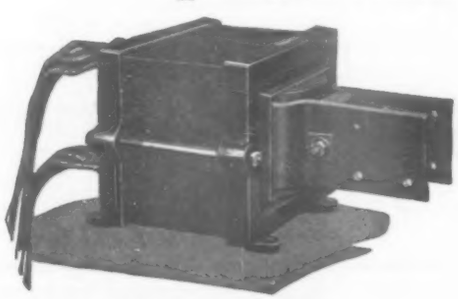

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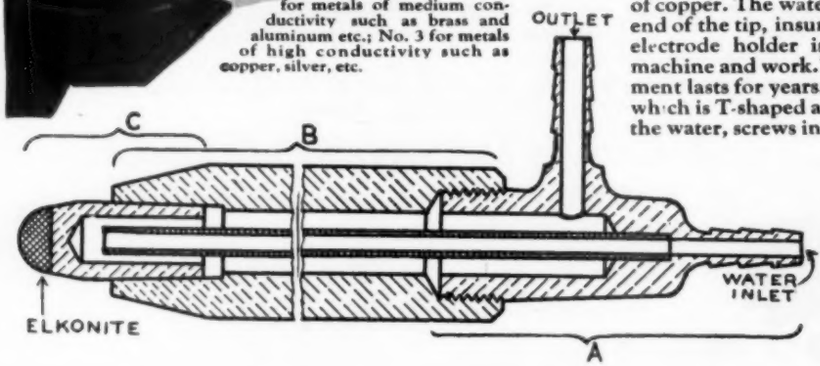

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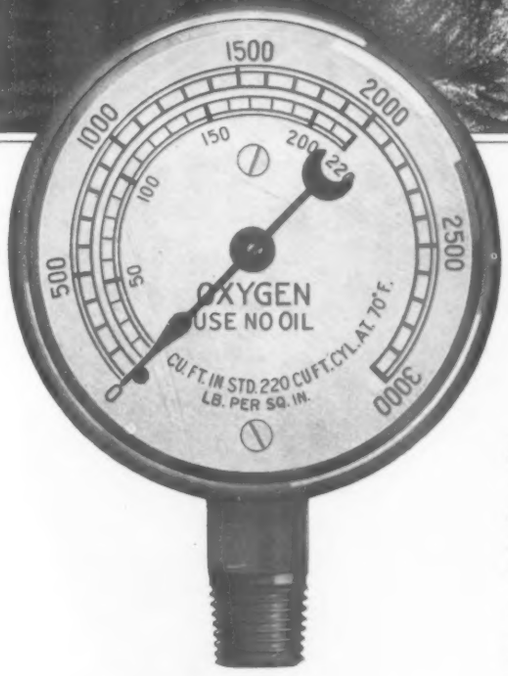

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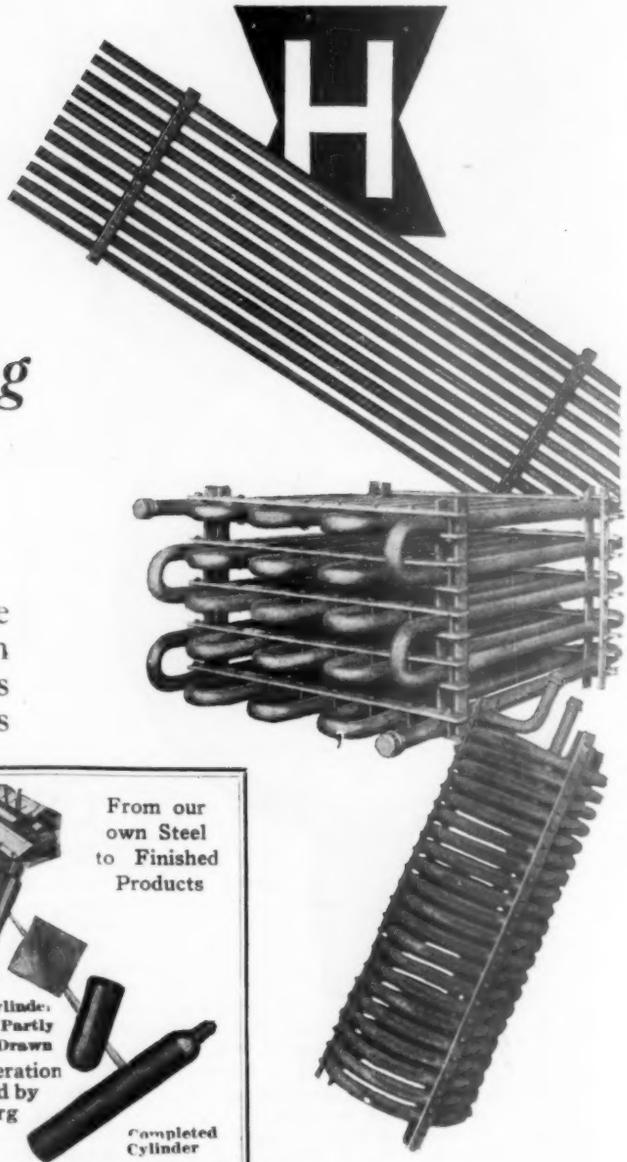

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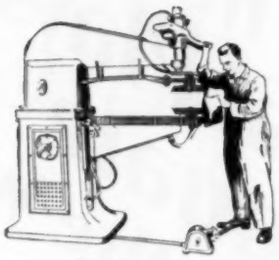

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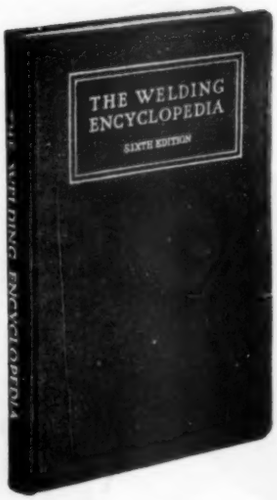

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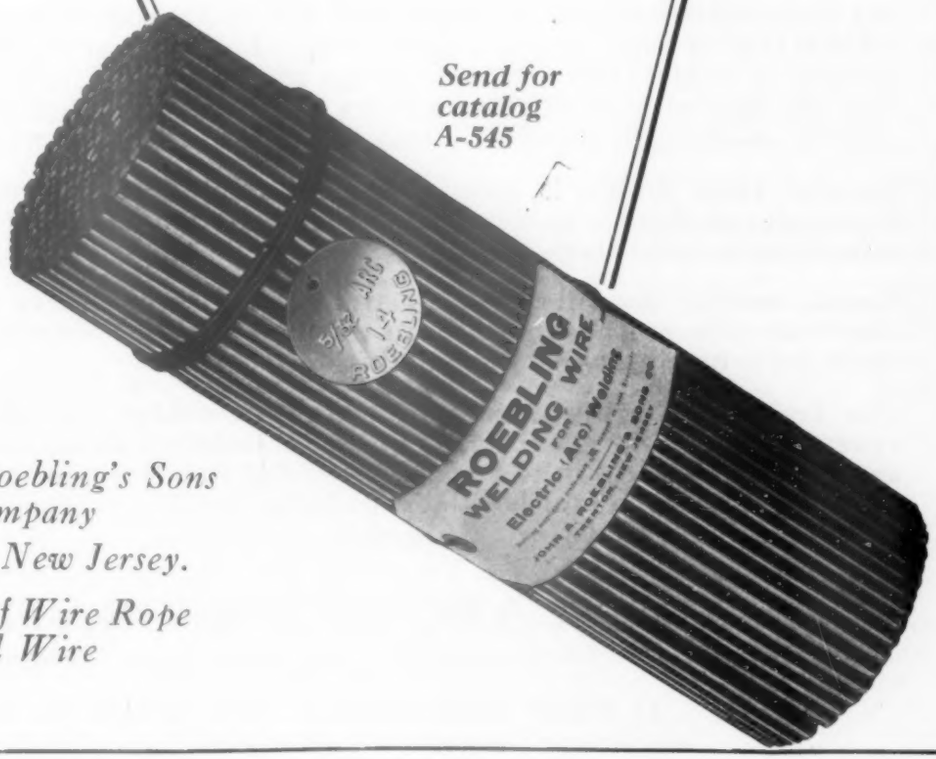

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EDITORIAL

Law or Trade Association

THE old cry of the distressed, "there ought to be a law," is rapidly giving way in the business field to the conviction, "there ought to be a trade association," according to Dr. Hugh P. Baker, Manager of the Trade Association Department of the Chamber of Commerce of the United States. The trend of trade regulation, in other words, is from within and not from without. As an indication of the momentum the movement of self-regulation is gaining it is pointed out that upward of fifty trade practice conferences have already been held and the number is mounting daily. Industries are taking up the task of setting their own houses in order instead of depositing their troubles on the congressional doorstep. But the warning is sounded by Dr. Baker that the mere organization of a trade association is not a panacea for trade ills. His advice is that the specific purposes to be accomplished by the association should first be determined.

New Processes and Employment

HERE and there, in industries where welding is just beginning to be used as a manufacturing process, are found a few workmen who are alarmed at the possible introduction of a labor-saving process or machine. From their viewpoint, a reduction in labor immediately results in unemployment. It does, in fact, appear to be true that during the last five years there has been a decrease in the number of workmen employed in an important group of industries, along with an increase in the total output of the same group. However, it also appears that in the industries where the output per worker is increased, the employment has actually increased, the unemployment tending to gain where one man's output remained relatively small. These facts were discussed at a meeting last month, in Chicago, of the American Economic Association and the American Association for Labor Legislation. Professor S. H. Slichter, of Cornell University, indicated that technical development in any industry has not caused displacement of labor except in a very indirect way. Wherever the installation of welding equipment means an increase in plant efficiency the chances of improvement in the employment conditions should be better than before.

Now You Tell One

THE inquiring reporter wandered into a railroad terminal a few hours after a locomotive had crashed into a bumper, the bumper evidently getting the best of it. Observing a rather confident looking master mechanic surveying the wrecked locomotive, the reporter asked what was to be done. "That's easy," replied the master mechanic, "We have another locomotive over here which had its rear end smashed. We will cut the wreckage off the front end of this one and off of the rear end of the other one, weld the two of them together and produce an articulated mallet type locomotive." Well, stranger things have happened in the welding industry.

Some Can Change With The Times

IT IS interesting to watch the reactions of industrial executives in connection with the introduction of new processes. There are some who are so firmly attached to the old ways that they can see nothing to do except go out of business when new methods are introduced. The extension of welding methods into the field of pipe lines in buildings threatens to do away with the use of a great many fittings which were necessary under the old order. However, if this change is a total loss it will be the fault of the fitting manufacturer. Some of them have seen the welding process grow in favor and recognized that these changes were not to be stopped, but by making a study of welding themselves have found that they can develop a splendid market for fittings which they make up by welding and which are particularly well adapted for welded installations.

Encouraging Good Workmanship

SALES managers ordinarily have their hands full when preparing sales literature, for selling is always hard work. There never seems to be a big enough supply of arguments in favor of the product or service to get action from all of the prospective customers. It is not to be wondered at, therefore, that practically all sales literature is full to the brim of the best available sales arguments. A folder received in the mail the other day contained a little suggestion that was somewhat different. Way down at the very bottom of the circular the following two lines were printed in capital letters: "Look upon welding as a profession rather than another job. Turn out a neat workmanlike finished product." The recipient can almost read the mind of the sales manager who turned out this circular. He is not only anxious to sell but is working hard to keep his customers from doing work which will not be a credit to the product. Undoubtedly, lots of us feel this way about our products but it is only once in a while that someone tries to do something about it.

A Gold Medal For The Office Central

ON MARCH 9th the Society for the Encouragement of National Industry in France presented to the Office Central d'Acetylene et de la Soudure Autogene a medal of gold as a testimonial of appreciation of the technical and practical work of that organization. The directors of the organization have already made public acknowledgement of the fact that through the presentation of the medal a just tribute is being paid, not to any individual but to an entire organization. The French association has, in fact, labored faithfully and intelligently for the steady development of oxy-acetylene welding. One by one they have taken hold of the important fundamental problems and worked diligently with them until they were able to give to their industry some definite and useful information on the problem, and they have made extended studies of details of procedure and presented the results of these studies in a practical way for the benefit of operators and supervisors. Their publications rank high in the great mass of documents which comprise the literature of the welding industry. Office hours at headquarters are from eight in the morning to seven in the evening and it is common knowledge that service of the sort rendered by this organization cannot be maintained without somebody doing considerable work outside of the regular hours. We are happy to extend our congratulations to the directors of the Office Central on the recognition which they have received for their faithful devotion to the interests of this industry, together with the assurance that we are confident that it is well deserved.

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Precision Weld Testing

Methods of Determining Physical Properties of Welds Under Conditions Met in Practice and Expressing the Results in Recognized Units

By J. B. Green*

INTEREST in super-strength welds is growing rapidly. This is a natural sequence to the fast widening circle of application of fusion methods of joinery throughout the metal using industries. The moment weld metal has a higher tensile strength than that of the parent metal, the methods of testing heretofore in vogue prove inadequate. Test bars welded with alloy steels giving super-strength welds break outside the weld, and all that

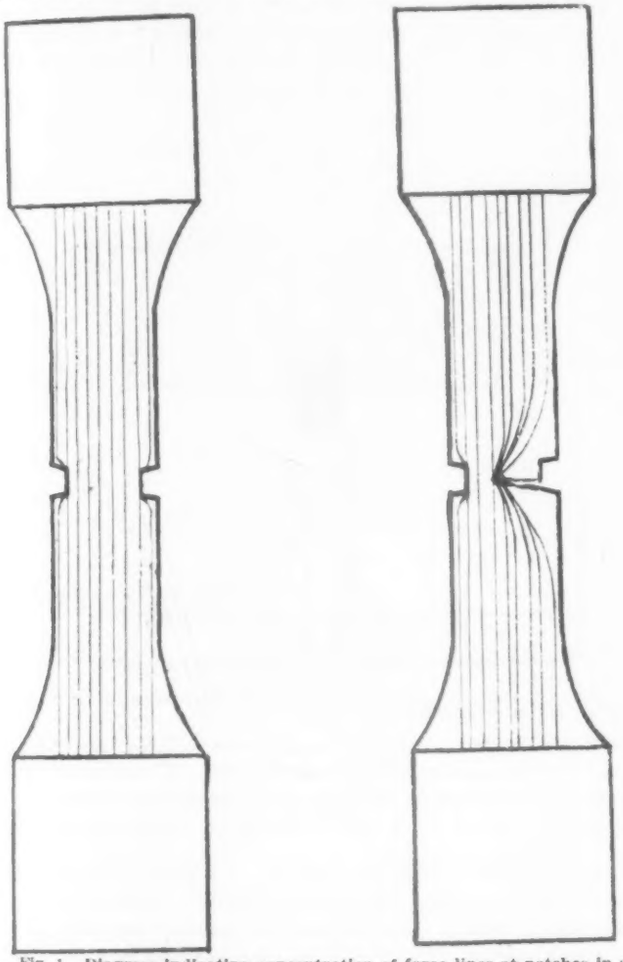


Fig. 1. Diagram indicating concentration of force lines at notches in a tensile test specimen and resultant failure through tearing instead of tension.

can be said of the weld is that it is stronger than the parent metal. It is useless to attempt to cut out a test bar from weld metal only because the size and shape of the weld as laid down affect its strength. To obtain useful engineering data on this subject, the weld as it is to be used in practice must be tested. Relative terms such as stronger, weaker, better, worse, etc., have very little significance to the engineer who is responsible for the design of a metal structure. He requires data expressed in recognized units of measure, as pounds per square inch.

To obtain such data, for example, in the case of a super-strength alloy weld made in mild steel, the test specimen must break in the weld under pure tension stress. This means that the pounds per square inch applied to the weld must be greater than that applied to the adjacent mild steel or, of course, the test bar will break outside the weld. It does no good to notch a test bar at the weld to make it break the weld. Even a small notch will, of course, cause the specimen to break in the weld because the forces concentrate at the notches, but one side or the other will be slightly weaker, and failure will occur by tearing instead of tension. Figure 1 indicates diagrammatically how the forces concentrate at a notch and how, as tearing proceeds, the concentration increases. Thus, a pull at the grippers of a tension testing machine may be only sufficient to apply a stress of 10,000 pounds per square inch, if uniformly distributed over the weld cross-section, but this could easily mount to 100,000 pounds per square inch where the forces concentrate around the notch.

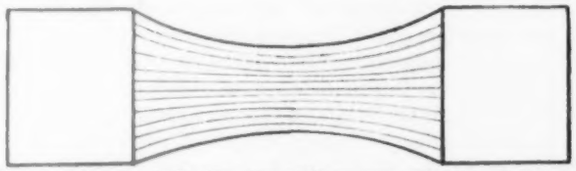


Fig. 2. Diagram indicating the uniform concentration of stress in a tensile test specimen having edges cut to a catenary curve instead of parrallel as has been customary.

The problem would be solved if a way could be found of concentrating the forces applied by the tension machine grippers uniformly so that they are equally distributed over the weld cross-section. To concentrate these forces, the weld section must have less cross-sectional area than any other part of the test bar. The author set himself this problem some time ago, and came to the conclusion that the forces must be concentrated according to some natural law. Visualizing the forces in a test bar as if they were suspended ropes furnished the inspiration.

Fig. 3. A Catenary tensile test specimen broken through the weld at the center.

A perfectly flexible conductor of uniform weight per unit of length throughout its length, such as a rope, for example, will, if suspended by its ends at the same elevation, take a natural curve which mathematicians call a "catenary." All portions of a cross section of such a conductor are in pure tension. The properties of a catenary curve are taken advantage of by engineers in designing overhead electric transmission lines, some coal bunkers, etc.

It seemed rational to believe that if a surface notch in a test bar influenced the direction of the lines of force causing the specimen to tear at the notch, the contour of the surface offered the means of controlling the desired concentration. Accordingly, some test specimens were prepared in the laboratory of the Fusion Welding Corporation and sent, together with a template carefully drawn to a catenary curve, to the University of Cincinnati for testing. Here the test bars were carefully ground to the template after removing the weld bead and tested while strain gauge measurements were applied at right angles to the axis of stress. The experiment indicated that the forces were uniformly concentrated as shown diagrammatically in Figure 2. Only mild steel electrodes and the metallic arc process were used for these preliminary tests, the object in the beginning being to determine whether or not catenary test bars produced the desired results. In Figure 3 is shown one of these catenary test bars. This one broke at 57,500 pounds per square inch, or about the

*President, Fusion Welding Corporation, Chicago.

tensile strength of the best grades of mild steel plate and considerably above that of most mild steel welds.

This specimen leads up to a short discussion of the significance of using catenary test bars for the improvement of welding materials and methods and of extending the welding process into new fields of usefulness among the metal working industries. Heretofore, the most common test bar has been one cut out of a welded mild steel plate with parallel sides, the weld being in the center with the bead left on. A fair proportion of such bars break outside the weld, but still many do not, and so engineers get the impression that welds lack uniformity and hence are

Fig. 4. Standard parallel side tensile test specimen showing characteristic break outside weld and half way between the weld and one gripper of the testing machine.

unreliable. Those who think still further realize that, even when the beads are trimmed off, a situation might develop wherein a specimen may break outside the weld and still the weld be weaker than the mild steel plate. Figure 4 illustrates such a case. The weld metal is substantially less compressible than the mild steel. It has an ultimate strength above the elastic limit but below the ultimate strength of mild steel. It acts the same as if the test bar were gripped at one end and in the center over the weld. Note in the illustration how the mild steel has necked down halfway between these points. The usual difference in ductility between weld metal and mild steel makes this necking off half way between the weld and one gripper a common experience in weld testing laboratories. Every specimen that shows

Fig. 5. Test specimen prepared for obtaining percent elongation of welds. Photograph taken after test has been made.

this phenomenon is not necessarily made with a weld weaker than mild steel, but it may be. A catenary test bar would give reliable information each time on this point.

So long as human skill makes and uses welding equipment and supplies so long will welds vary in tensile strength as between one and another seemingly made alike. The only way, therefore, to convince engineers of the reliability of welding is to move this range of variation up so that the lowest tensile strength is above that of mild steel.

A study of the specimens which broke in the welds when test bars of the shape heretofore in common use is the starting point. Such a study resulted in the high test weld used in the illustration Figure 3. This weld was made with a surfaced electrode recently developed by the Engineering Department of the Fusion Welding Corporation, and marketed under the trade name of No. 18 WELDITE Yellow Jacket.

An examination of test specimens breaking in the weld usually shows the presence of incomplete fusion or blow holes or both. When using ordinary commercial mild steel electrodes at high enough current densities to insure complete fusion in the hands of operators of medium skill, blow holes usually result. Thus with such electrodes there is a tendency toward welds which either lack fusion or contain blow holes. This indicates the desirability of an electrode giving greater penetration than usual and also giving a sound weld at higher than customary current densities. A knowledge of the handbook data required for electrode design permits deliberately producing such a filler rod which in turn makes it possible for users of metallic arc welding to improve the quality of their product. It becomes more reliable and quite possibly will result in convincing many prospective users who have, up to now, been doubting Thomases on the subject of the reliability of welds. This electrode is only suitable for heavy welding because it acts just the reverse of the ordinary commercial mild steel electrode and instead of introducing blow holes at high currents, it does so at low currents. Another electrode is required for light welding.

The use of catenary test bars permits carrying this sort of development work one stage further. Instead of stopping at the tensile strength of mild steel, this study is going on above such limit. The case cited above is but one used for illustration. Gas welding rod is being improved by the same method. Not many years ago, welds made with mild steel filler rods were considered as castings having the composition of nearly pure iron and, being castings, would therefore always possess less strength than rolled mild steel. As a matter of fact, commercial welds made either by the gas or electric processes contain oxides and nitrides, often to such an extent that they are brittle. However, by controlling this oxide-nitride content, it is possible to raise the tensile strength of the weld casting above that of rolled

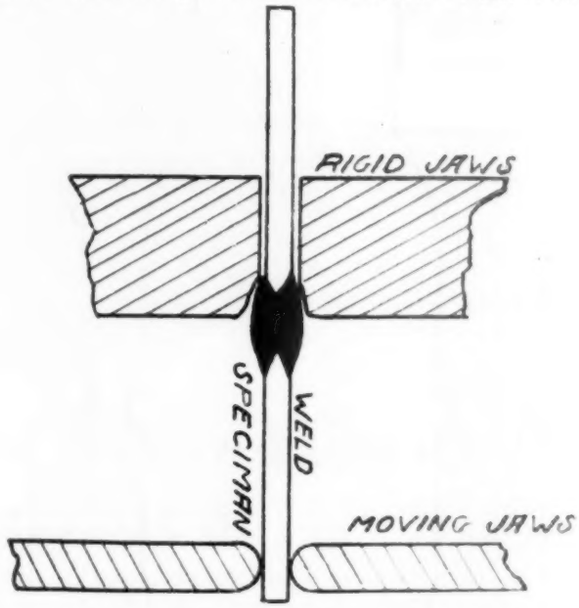


Fig. 6. Essential parts of machine for alternating stress tests of welds shown diagramatically.

mild steel without impairing the usefulness of the weld because of brittleness. In applications where filler rod cost is not paramount, super-strength, together with ductility, even substantially exceeding that of rolled mild steel, can be obtained through the use of alloys.

Probably still greater advances are possible in welders' technique than in welding rod design. So long as the test specimens in question break in the welds, catenary test bars are not required for such studies. However, if the art of welding is to be pushed forward so that all welds can be made stronger than mild steel, when so desired, catenary test bars or their equivalent are necessary. It is hoped that one or more of the recognized national technical societies will investigate catenary test bars for tensile testing of welds and established standard contours.

The use of catenary test bars will solve only one question as regards the physical properties of welds. Mr. R. H. Stevens, Chief Engineer of the Bethlehem Steel Corporation, Cambria Plant, Johnstown, Pa., has done some splendid work in the development of test methods for properties other than tensile strength. The Stevens ductility test is as startling in simplicity as it is accurate in results. A regular test bar is welded with the axis of stress, the bead planed off and then pulled in a tension machine. An ordinary extensometer such as is regularly used for measuring the per cent elongation in all tension testing is all that is required. It is used in the customary manner, failure being considered as occurring when the first surface

cracks appear on the weld. A test bar prepared for elongation testing is shown in Figure 5.

Another test developed by Mr. Stevens is an alternating stress one. By means of a comparatively simple machine, an alternating stress can be applied directly to the weld metal and the number of alternations required to effect failure accurately measured. The essential feature of any such machine is the concentration of all the stress in the weld. Mr. Stevens accomplishes this by leaving the bead on the weld and gripping the specimen with jaws curved to practically fit the contour of the bead as shown diagrammatically in Figure 6.

Accurate shearing tests may be accomplished with any contrivance capable of shearing a weld and, at the same time, measuring the force required to effect rupture. Such tests,

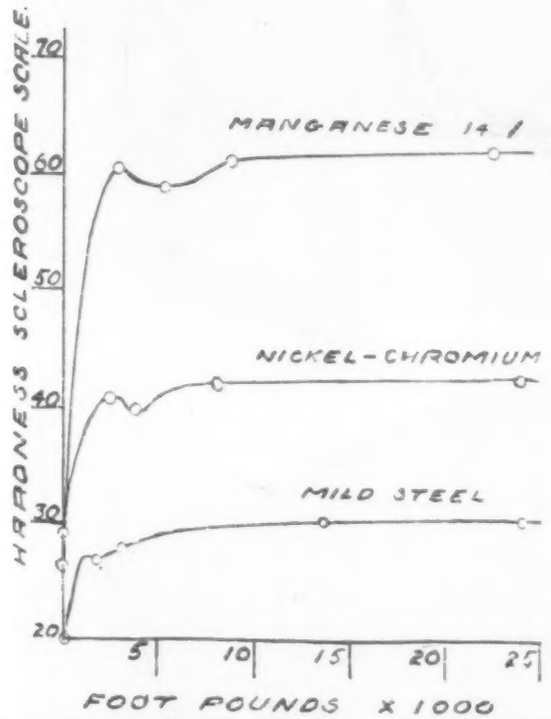


Fig. 7. Curves showing the capacity for work-hardening of various metals, permitting a comparison between initial and final hardness.

together with compression tests, can be made with most any tension machine capable of measuring compression as well and the required technique is obvious to anyone familiar with metal testing.

The Engineering Department of the Fusion Welding Corporation have recently developed a method of hardness testing which will, no doubt, prove valuable to those who use fusion methods for laying down hard and wear resisting surfaces. The moment the property of hardness is significant in connection with a metal surface, the influence of work, usually cold, on the metal becomes a factor. In other words, the initial hardness of a metal is usually only part of the story and more often than not the smallest part. The capacity of the metal to harden through work, together with its tendency to become brittle from such work, is generally the deciding factor. Curves such as the ones shown in Figure 7 tell a far more useful story than merely a statement of initial hardness as determined by anyone of the recognized hardness testing methods. A machine has been built for delivering repeated, measured blows on a planed weld surface. The intensity of each blow should apparently be somewhat above the elastic limit in compression of the weld metal being tested at the moment the blow is struck. Means must be provided for measurement of the foot pounds of energy delivered with each blow. For practical reasons, the scleroscope seems best suited for testing the worked surface of the specimen at regular intervals in applying the cold work. This furnishes the data for plotting curves between hardness and foot pounds of work. Tests of this kind indicate that often metal surfaces having little hardness initially, will quickly cold work to extreme hardness. If brittleness develops during work, the surface noticeably spawls off and so is readily indicated in testing.

Some years ago, the author published an article on "Observation Testing" which covered both Operating Characteristics and Weld Properties. Such testing is just as useful as ever in its place. As the use of welding extends, more and more Precision Testing is required. Because the physical properties of welds are so markedly affected by the size and shape of the parent metal being joined, inherent difficulties are introduced in practical precision weld testing that are not often encountered in other fields. Other precision tests than those indicated in this article have been made on welds. However, the ones listed here permit determining most of the desired physical properties of weld metal as laid down in practice. The outstanding characteristic of the Stevens tests and those of the author is the expression of results in recognized units, such as pounds per square inch, per cent elongations, etc., thereby eliminating the necessity of such relative expressions as "stronger than," almost meaningless to the engineer.

These recent advances in testing of Weld Properties by precision methods pushes the subject ahead of precision testing of Operating Characteristics before such tests can be brought to an equivalent position, much further research work is required. The work with infra-red light photography together with oscillograph records, spectrographic analysis of arc vapors, ionization potentials in connection with the author's thermocouple theory of arc heat distribution, must all be further investigated in connection with metallic arc welding and chemical analytical methods devised for solid non-metallics, in filler rod in connection with gas welding are yet to be completed. This and more must be done before Operating Characteristics may be fully described in scientific terms. The specification writers may then safely proceed. Until adequate specifications can be written, the users of welding are best off without them.

NEW PAMPHLET ON MECHANICAL GAS WELDING

"Developments and Progress of Mechanical Gas Welding" is the title of a new pamphlet recently distributed by the Air Reduction Sales Company. It is a reprint of a paper by Mr. J. L. Anderson, of their Engineering Research Department, which was presented at the last annual meeting of the International Acetylene Association held November 14th to 16th, 1928. As its title would indicate, it is a very thorough and comprehensive article containing the latest information in regard to all the various phases of mechanical gas welding. A few of the subjects covered are: the mechanical welding tubing and pipe, mechanical welded flat sheets and plate, mechanical weld reinforcement, and quite an amount of both scientific and practical discussion of the effects of the mechanical welding process on the metals welded. In conclusion Mr. Anderson says that the field for this process has only barely been touched and that the manufacturer who can apply it in his production should give it the most serious consideration.

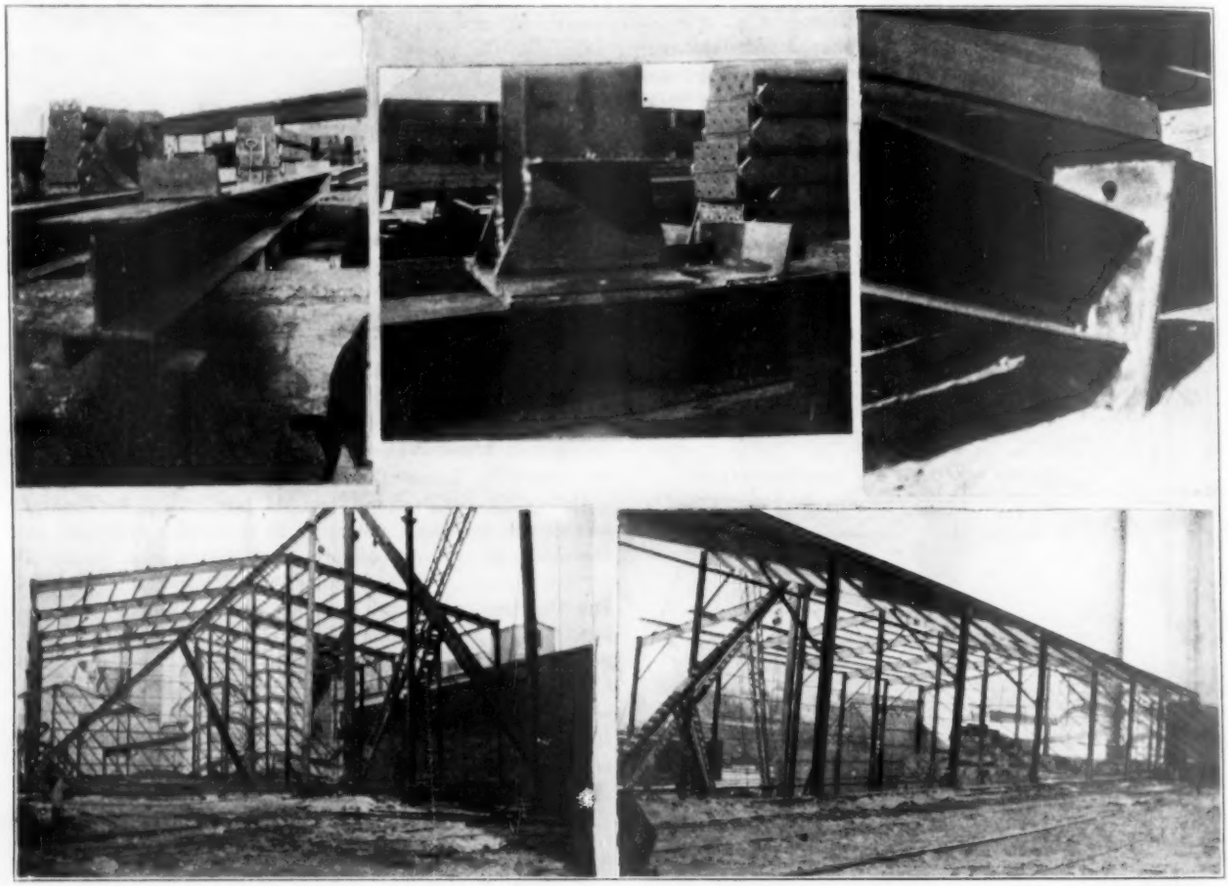
C. H. DOCKSON CO. MOVE TO LARGER QUARTERS

C. H. Dockson Co., manufacturers of oxy-acetylene welding and cutting equipment, have moved to their new location at 40-42 W. Milwaukee Ave., Detroit, Michigan. Their new quarters provide several times the space occupied by the old plant, which was not large enough to take care of the expanding business. The capitalization of the company has also been increased.

WELDED STRUCTURAL STEEL FORMS FRAME FOR LARGE HAY BARN

By F. H. Marsh, Omaha, Nebraska

The American Milling Company of Omaha, Nebraska, has recently built a large hay barn with a welded structural steel frame covered with galvanized corrugated iron. The building is 190 feet in length and 75 feet in width, and about 100 tons of steel was used in its construction. The frame work consists of 8-inch H-columns with all connections welded to them, 24-inch I-beams for rafters, and a great number of channel purlins and girts. Because of the probability that the building will be taken down and moved at some future date, all field connections are bolted. The job therefore was entirely welded in the shop and brought to the building site ready to be bolted in place. The upper three pictures show how the various assembly connections looked welded to the beams. The lower photos show the frame-work of the building as it appeared during the course of the construction.



Upper Three Photographs Show Details of Welded Assembly Connections. Lower Photographs Show the Hay Barn During Construction.

NEW BUILDING CODE ALLOWS USE OF WELDING

Thirty-eight municipalities in the west and south now have sections in their building codes covering the electric welding of buildings, according to an item in the General Electric Review for April. These cities, now operating under the regulations laid down by the Uniform Building Code, have followed the lead of Sacramento and Alhambra, which adopted that code late in 1927. They are as follows:

Sacramento, California
Alhambra, California
Fontana, California
Redlands, California
Claremont, California
Walnut Creek, California
Tulare, California
National City, California
Oceanside, California
San Bernardino, California
Laguna Beach, California
Pomona, California
Fresno, California
Piedmont, California
San Rafael, California
Coronado, California
El Monte, California
Ontario, California
San Fernando, California
Livermore, California
Berkeley, California
Martinez, California
Compton, California
Corcoran, California
Madera, California
Eugene, Oregon
Klamath Falls, Oregon
Shreveport, Louisiana
San Jose, California
Visalia, California
Fullerton, California
San Francisco, California.
Pittsburg, California
Monroe, Louisiana
Meridian, Mississippi
Eldorado, Arkansas
Prescott, Arizona
Tucson, Arizona

According to the new building code section for these cities, it is now legal for the Commissioner of Buildings in each place to grant, in the same manner as for riveted frames, permits for the erection of electrically welded steel building frames also.

Section 2710 of the Uniform Building Code authorizes the use of welding and sets forth the essential elements needed by engineers and architects in working out the designs for welded joints in steel beams and columns used in building construction.

The Pacific Coast Building Conference is an organization whose members are the building inspectors and commissioners of buildings, banded together to secure the adoption of a uniform building code. As a result, engineers and architects who design buildings, and contractors who build them, may have but one type of code to confrom to instead of a different code in each place.

In addition to the list of names given, there are many cities in which the code is either now being adopted or the ordinances of adoption are being prepared. In the eastern section of this country, various organizations have been at work for some time on a building code incorporating a section covering welding.

The Acid Test of Quality Selling

Welding Contractor Sells 70,000 Extra Feet of Welding on Tanks by Actually Trying What Was Said to Be Impossible

By J. D. Tierney*

FOR the sake of argumentation some people will take the stand that there is really no "acid test" for anything, and men who have made a study of whether there is, or is not, such a thing as an "acid test," conclude that there is no earthly being or thing which is infallible.

In this article, we are going to accept the agreement and conclusions which our learned brothers have proven, but we are also at the same time, going to accept what Charles F. Kettering uses as one of his maxims for progress. Mr. Kettering is President of the General Motors Research Corporation, Vice President of the General Motors Corporation, a Director of the Pratt & Whitney Aircraft Corporation, and incidentally he is one of the world's foremost engineers and directors of research.

His experience has taught him to believe that "IT TAKES A CERTAIN AMOUNT OF IGNORANT INTELLIGENCE, AT TIMES TO PROGRESS THINGS."

How Ignorant Intelligence Works

Time after time he has been told that the things on which he was making research were futile attempts to do what other experts agreed upon as "impossibilities." His research activities were not of the past, or the present. His field of research had to do with the future for which there was no reference books or condensed laws or rules. And time after time, when his associates considered that his attempted problems were a waste of time and effort, Kettering was "intelligently ignorant" enough to keep at the solving of his problem and his accomplishments have proved, by his great majority of successes, that his maxim is one of usefulness and well worth while adopting under certain extenuating circumstances.

Some welding job shop owners who have gone into the business of making tanks to specification are finding their venture a fairly profitable one. Others have it to say,—"that it just doesn't pay." There are also a few job shop owners who have found it highly profitable. Let us not forget the job shop owner who has not endeavored to establish any tank business because,—as he will tell you,—"there isn't a chance, you cannot compete with the old established tank fabricators."

Let's boil these differentiations down to see if each claim will stand the "acid test."

(A) Claims there is a FAIR PROFIT in making welded tanks to specification.
(B) Claims THAT IT DOES NOT PAY.
(C) Claims it is HIGHLY PROFITABLE.
(D) Claims "THERE ISN'T A CHANCE FOR WELDING JOB SHOP OWNERS TO COMPETE WITH ESTABLISHED TANK FABRICATORS."

Some Must Be Wrong

It is an established fact that there are hundreds of welding job shop owners who manufacture and sell tanks, so, (D) is absolutely wrong in his claim and in proving his claim, a false one, we establish the fact that IT IS POSSIBLE FOR WELDING JOB SHOP OWNERS TO COMPETE WITH ESTABLISHED TANK FABRICATORS, because there are hundreds of cases to prove the possibilities.

The claim of (B) must be wrong and false, when (A) already proves by his statement that he has derived a "fair profit" and (C) offers substantiating evidence of an experience which is "highly profitable." So, as the two negative claims are bared, we also learn IT IS PROFITABLE FOR THE WELDING JOB SHOP OWNER TO COMPETE WITH ESTABLISHED TANK FABRICATORS AND MANUFACTURE WELDED TANKS, AS A DEPARTMENT OF THEIR WELDING SERVICE.

The fact that (A) and (C) still differ as to the extents of profit where one says "fairly profitable" and the other says "highly profitable" does not present an alarming difference because a cross examining, in which proper questioning would be used, would produce the fact that the difference between "fair profits" and the "higher margin," than just a "fair profit," is entirely due to the advertising-selling and management procedures used by the respective parties. THIS CONCLUSION WOULD NATURALLY POINT OUT THE FACT THAT IT APPARENTLY LOOKS LIKE (A), (B) AND (D) MIGHT ALSO PROFIT AS MUCH AS (C) BY APPLYING THE SAME PRINCIPLES WHICH (C) HAS USED SO SUCCESSFULLY.

Decide and Then Do It

The experience of (C) seems to teach that he has been following Mr. Kittering's maxim and has been "ignorantly intelligent" enough, not to place too much confidence in the discounting claims of the majority of welding job shop owners, who unthinkingly make assertions and broadcast rumors which suggest that there are no possibilities of excellent legitimate profit in establishing a tank business, as a department of their welding service.

If the (C) in this article only represented one single welding job shop, rather than hundreds, the one instance of success would be sufficient evidence to establish the truth, that most welding job shop owners can develop a profitable tank business, if like (C), they will first decide to do it and THEN DO IT.

Many times it does not pay to be lead by the consensus of opinion and the following experience will bear evidence of adoption of "ignorant intelligence," . . . . . Two years ago, thirty-one established tank fabricators, (not welding job shops) were questioned, some directly by the writer and some indirectly by my associates, and the tank makers were asked,—"Have you ever thought about the probabilities of selling the idea of double welded tank joints to your customers and prospective customers?"

A Good Idea Discouraged

Twenty-seven replied that they considered it entirely improbable and nearer to impossible. Three thought it was too much of an educational matter to prove profitable, because as they said,—"the amount of advertising-selling expense involved, would be too great, considering the volume of business which would result from the advertising-selling efforts." One tank maker, only one, said he had sold the idea to a few of his tank customers.

Most of these concerns, in their advertising-selling material, boasted of the fact that they were "experts" in their line and according to their advertising and considering the long length of time all of them were established in business, their experience was truthfully the kind which qualified them as "expert" in their line of business. So with the majority of "expert" advice against the idea of selling double welds instead of single welds on tank joints, the task seemed a hopeless one, just another brilliant idea doomed to extinguishment, if the "expert" advice was accepted.

It was decided to use a little "ignorant intelligence" and put the question up to *tank users* instead of *tank makers*, and it was found as consistent efforts were carried on, that contrary to

*Storts Welding Co., Meriden, Conn.

the belief and decision of the "experts," tank users were agreeable to anything which would retard corrosion in tanks and incidentally cut costs by extending the life of the tank.

Sells 70,000 Feet in 14 Months

Introduction of the idea was expanded and from December, 1927 to January, 1928, a period of 14 months, one little welding job shop sold more than 70,000 lineal feet of the additional "improbable" and "impossible" inside weld.

During the Convention of The American Welding Society at Philadelphia last October, the writer mentioned the progress on this idea to the Editor of The Welding Engineer. Mr. Card told us he was going to pass the idea along to other welding job shop owners whom he knew to be endeavoring to build up and establish a profitable tank business. In a recent letter Mr. Card wrote that he had talked to some of the welders about the idea and their reaction to it was negative, one shop owner stating that the idea sounded like,—"trying to sell Florida real estate."

It was once said that if every welding job shop owner would have Mr. Kettering's maxim painted on a large sign and conspicuously displayed in his shop that it would prove of very great value to the shop owner because he might read and reread it and allow it to be a caution to quick decisions,—sweeping statements—and all-embracing generalities.

Adopt Plans That Stand Test

When testing proves that an idea has sound and encouraging possibilities, it is a good plan to adopt such ideas and put them to work, whether the idea is original or copied, because the profits derived from one's efforts are better in the bank, than not making the profits at all, when one follows the crowd who says,—"it can't be done."

In the progression of the idea of the double weld, our experience has convinced us that it is highly profitable. Not only to our own gain by increased production and profit, but more profitable to the tank user. When a double welded joint is furnished, instead of the single welded joint, the tank user purchases a "post of metal" at all joints, a type of weld which will outlast the tank plate, when corrosion is the thing to combat.

When we decided to take advantage of the exceptional selling features which Armco Ingot Iron Plate offered, as a standard plate to be used instead of steel plate, we were confronted with one real important factor which gave us the idea of the necessity of a double weld in special cases and the safe guard of a double weld in general cases.

The Importance of Double Welding

In welding a corner joint, (the vee type of joint made by placing the sharp edges of plates together, just touching each other) the amount of metal which is required to make a heavy reinforced weld is limited to a certain degree. Any additional metal, more than the required amount, becomes an unnecessary surplus, adding cost to the welding application. When the right amount of welded metal is properly applied, even in its very best form as to penetration and control by the operator, the inside of the single weld is a continuation of small fissures and crevices, which are ready pockets for the corrosive elements to pocket into and begin the work of removing the metal's impurities, by the process of corrosive deterioration.

The "impurities," the carbon, manganese, phosphorus, silicon and sulphur content of commercial steel plate varies considerable, containing generally a very high proportion of these impurity elements, which are so readily attacked by corrosion. In special cases where extreme rapid deterioration by corrosion has taken place, analysis proves that the steel plate contains higher than general percentage proportions of the impurity elements and segregations of these impurities contributes to the rapid deterioration of the plate.

In standardizing on Armco Ingot Iron Plate, we were automatically getting away from this high impurity condition and hazard, because the total amount of impurities in Armco Plate were guaranteed to be less than 16/100 of 1% and it was apparent and safe to conclude that the steel welds which would join the purer plates, would be the first point to deteriorate, unless the weld, in cross section area, would be very heavily reinforced to compensate. In our experience with Armco Plate outlasting steel plate from one and one-half to two times, a steel weld, unless heavily reinforced would be a weak link, even in the use of mild steel welding wire.

Getting Rid of Corrosion Centers

So it was decided to adopt a heavy convex type of outside weld on all joints and to use an additional concave weld on the inside of all joints, to eliminate all possibilities of fissures and crevices into which the corrosive elements might become pocketed and begin the work of deterioration.

The two welds, the convex outside one and the concave inside one, form one of the finest selling points and cost cutting arguments that it is possible to present to any tank buyer or tank user. The "post of metal" carries an appeal which is readily understood and more readily desired by tank buyers who are keen for eliminating future upkeep tank costs, and it does not require any super-sales-effort to have the tank buyer pay the slightly increased initial cost of the tank product, which he needs because of its "quality values."

The advertising-selling procedure used to sell this idea, is nothing more or less than a presentation of facts to the prospective tank buyer and our present repeat customers. Most people who know little or much about the tank game will venture to say that most tank buyers buy on "price only" when they are making tank purchases. Application of Mr. Kettering's maxim has proven to us that this assertion is a lot of pure "bunk."

Buyers Can Be Made to See Values

It is true, however, that the majority of tank buyers are not familiar with, or do not thoroughly understand, the important differences that exists as to tank values and for that very reason many buyers are now purchasing on "price-only-issues" and will continue to follow this procedure, until some quality tank maker will present the clear facts which educate the buyers to know the profits to be gained by choosing between tanks which are produced on a "hurried-up-don't-care-what" basis and the "quality-tank-product," which is offered to buyers, as the best value it is possible for them to procure. The initial cost difference of the two products does not represent more than 10 to 15 per cent. In other words, the use of double welded joints instead of single welded joints will not require more than 15% of present "price-issue-tank" costs. When these issues offer the buyer at least 50 to 100% additional length of life in the tank use, it is nothing more than a common sense sales argument, to sell what most tank buyers are waiting to hear and are ready to take advantage of.

Tank buyers as a whole are always receptive to receiving the most value they can purchase, at a cost which can be regarded as the lowest figure, consistent with maximum value, and after they have established a contact of supply where they receive the maximum value purchase, they cease to scour the market for "price-only." An example of this fact can be cited in one manufacturer who had been dealing with one source of tank supply for more than thirty years. A welding job shop salesman called upon this account consistently for two years, and the following was most generally offered,—"we have dealt with a five hundred thousand dollar concern for more than thirty years and our metallurgist tells us we are getting about as good a value as the market can offer in our tank requirements. Your welding company is only a little company and we don't see how it would be possible for your company to improve on the product, or offer a better value than the five hundred thousand dollar company is furnishing us."

During the two years of this instance, we were selling the steel tank. We not only hit the purchasing department of this

concern hard, but we also started a barrage of direct mail to their metallurgist.

Trial Order Grows to Big Volume

Finally we were entrusted with an order for four tanks; a month later we received an order for eight. In the months of 1927 which followed the initial orders, we received a total of a little over $2,000.00 in volume. During the year of 1928 this concern purchased over $9,000.00 worth of double welded tanks from us, and their repeat business is continually coming in this year of 1929. If it pays this large user and other large users of tanks to purchase the "quality product," the small users can likewise profit, and the one way to have the small users profit, is to have them learn the same facts, the larger users have learned. The one way to have a big production in your welding job shop tank department, is to tell the story to hundreds of small users.

Thousands and thousands of manufacturers throughout the United States are buying thousands and tens of thousands of tanks yearly, for plating, quenching and hundreds of special uses, where corrosion is continually at work.

Experience Shows the Way to the Market

Our experience plainly and clearly proves to us, that there is a ready market for double welded tanks and it does not require high pressure selling or lengthy sales argumentation to make tank buyers think around and about the values they can procure when they specify this feature as a means of receiving the extra long tank life and value, which can be had for the small additional initial cost.

Let those who want to follow the old idea of cut, cut, cut, materials and workmanship, in an effort to reach the one issue of "price," do so, at their heart's content. Let them be the low bidder with their low price and low value product. A general, when he observes a weakness in his lines, will strengthen the weakness at any cost, and the generalship of the tank seller today, is to use observation and point out to the buyer, the weakness which exists in "price-issues" only, because the "acid test" will prove without question or doubt, that PARED PRICES CANNOT BE FIGURED AT A MAXIMUM OF PROFIT AND VALUE TO BOTH THE BUYER AND THE SELLER.

THE ANNUAL MEETING OF THE AMERICAN WELDING SOCIETY

The national organization of The American Welding Society will hold its annual meeting during the days of April 24th, 25th, and 26th, 1929. The place of meeting will be at 33 West 39th St., New York City, and it is expected that all sessions will start promptly as scheduled. The members and their guests will be requested to register Wednesday morning, April 24th. The program, which is as yet tentative, is as follows:

WEDNESDAY, APRIL 24, 1929

Morning

Technical and Business Sessions

10:00 a. m. to 10:30 a. m., Room 2, 5th Floor, Business Meeting, F. T. Llewellyn; President, Presiding.

Report of President, Report of Tellers' Committee, Election of Officers, Presentation of Miller Medal.

10:30 a. m. to 12 noon, Room 2, 5th Floor, Technical Session.

A symposium on "How to Organize and Operate an Industrial Welding School."

Afternoon

Technical Session

2:00 p. m. to 5:00, Room 2, 5th Floor, Technical Session, F. M. Farmer, Presiding.

"Physical Properties of uBtt Welds," by G. Lobo, Westinghouse Electric & Manufacturing Company.

"Welded Pipe Joints," (author to be announced later).

Evening

Board of Directors' Meeting

7:30 p. m.

Meeting of Board of Directors of American Welding Society. Appointment of committee chairmen and other officers. Committee reports. Plans for the coming year.

THURSDAY, APRIL 25, 1929

Morning

Technical Session

10.00 a. m. to 12, Room 2, 5th Floor, F. T. Llewellyn, President, Presiding.

"Design of Joints for Welded Steel Structures," by A. Vogel, General Electric Company.

"Welding in the Heating and Ventilating Industries," by Prof. S. E. Dibble, Carnegie Institute of Technology.

Afternoon

Technical Session

2:00 p. m. to 5, Room 2, 5th Floor, A. G. Oehler, Presiding.

"Welding in the Aircraft Industry," by R. M. Mock, Bellanca Aircraft Corporation.

"Thermit Welding of Rail Joints for Main Line Track of Steam Railroads," by J. H. Deppeler, Metal & Thermit Corporation.

Evening

Annual Dinner

6:30 p. m.

The dinner, as last year, will be arranged as a stag affair. Unusual efforts are being made by the Dinner Committee to provide a good dinner and special entertainment. There will be no speakers. Tickets should be secured from the Secretary at once. Price, $6.00 per person.

FRIDAY, APRIL 26, 1929

Morning

Technical Session

10:00 a. m. to 12, Room 2, 5th Floor.

A Symposium on Welding in the Chemical and Process Industries.

"Welding Aluminum in the Chemical Industry," by W. M. Dunlap, Aluminum Company of America.

"The Production of Ductile Welds in Nickel and Monel Metal," by N. B. Pilling, International Nickel Company.

"Welding in the Gas-Handling Industry and Requirements of Welding in the Chemical Field," by R. S. McBride, Assistant Editor, Chemical and Metallurgical Engineering.

FRIDAY, APRIL 26, 1929

Morning

Technical Session

"Welding of Pressure Vessels for High Temperature and Pressures," by T. McLean Jasper, A. O. Smith Corporation.

Afternoon

Annual Meeting

American Bureau of Welding

2:00 p. m. to 3:45, Room 3, 5th Floor, C. A. Adams, Director.

Review of progress made by various research committees of the Bureau. Plans for future investigational activities. Election of Officers. Appointment of Executive Committee.

3:45 p. m. to 5:30, Room 3, 5th Floor.

Meetings of Structural Steel Welding Committee, J. H. Edwards, Chairman.

Review of progress made to date. Discussion of future activities of committee.

C. G. M. A. ANNUAL REPORT PUBLISHED

The Compressed Gas Manufacturers Association, 120 W. 42nd St., New York City, has just published in booklet form the proceedings of the sixteenth annual meeting of the Association, which was held at the Hotel Astor, New York City on January 21st. The report fills 125 printed pages and contains the text of all committee reports, a list of members and guests who attended the annual meeting and the text of the papers which were read before the meeting.

A 200-MILE WELDED PIPE LINE

A pipe line 205 miles long, running from Jal, New Mexico, to El Paso, Texas, is now being electrically welded. This pipe line, 16 inches in diameter, will carry gas for the El Paso Utilities Company, and is being installed by Smith Brothers, Inc., general contractors.

The electric arc welding of the entire pipe line is being done under the direction of Messrs. Fred Clark and F. G. Hoffman. A total of 27 General Electric welding equipments are in use, some mounted on Fordson tractors and driven by the tractor engine, and others mounted on trucks and trailers.

The pipe, in 30-foot sections, is strung along the cleared right-of-way. Seven of the 30-foot lengths are than lined up, making a section approximately 200 feet long. One welding crew fixes the sections temporarily in position by tack welding and another completes the welds.

Fig. 4—Tractor Used in Handling Sections of Pipe.

The tack welding machines are self-propelled equipments, as the first welding crew is often some distances ahead of the men who complete the welding operation. The pipe is turned, as the welding progresses, by one man using long-handled tongs. Every seventh joint is an expansion joint. This consists of a short piece of pipe with upset corrugations. This joint adds flexibility to the pipe as well as allowing for expansion and contraction when in use.

After the 200-foot sections are completed another crew lines them up with the completed pipe line, using a caterpillar tractor and boom. As the pipe cannot now be turned, the welds are made by the "bell-hole" method, in which the operator moves his own position to weld all sides of the pipe, making the weld on the lower side from an excavation dug beneath for that purpose.

By the use of $\frac{1}{4}$-inch diameter welding electrode and a current of approximately 175 to 190 amperes, the greatest welding speed consistent with the highest quality weld is obtained. Each operator is able to make approximately 13 welds in ten hours.

After the final welding operation is completed, the joints are tested and then treated with a corrosion resisting compound, after which the pipe is lowered into the ditch.

Fig. 1—Close-up View of Weld. Fig. 2—Workman Welding Pipe. Fig. 3—Expansion Joint Welded in Place.

SCHOOL FOR PIPE WELDERS IN PORTLAND

Anticipating an early demand for more welding on pipe systems in buildings, the steamfitters and plumbers of Portland, Oregon, have made definite plan to become acquainted with the possibilities of pipe welding and methods of using the welding torch in their work. An apprentice school has already been started. This school takes care of a class of nine steamfitters from the local steamfitters' union, giving them two nights each week. Plans are already under way to start a similar course for the plumbers. The instruction is given by Mr. N. A. Hanson, whose welding experience dates back to the year 1910. Since that time he has had considerable experience in all kinds of work including some two years' experience in the Todd ship yards at Tacoma, Washington. Just before starting his teaching activities Mr. Hanson was employed on the thirteen buildings which comprise the U. S. Veterans Hospital and did all the welding involved in that construction, which lasted over a period of eighteen months. This instruction is being given at the local vocational training school and in an interview with Mr. E. R. Hodson of the Portland Oxygen and Hydrogen Company, The Welding Engineer representative was advised that steamfitters who are now taking the course are becoming quite proficient with the torch.

CLEVELAND WELDING SCHOOL MOVES TO NEW QUARTERS

Notice has been received from Messrs. Randall and Scotte, proprietors of the Cleveland Welding School, located at 2094 E. 19th St., Cleveland, Ohio, that the school will move into new quarters on April 18th. The new building will contain 5500 sq. ft. This space is all concreted and the lighting and ventilating are especially good. The move is made necessary due to the constant and increasing demand for trained operators in the Cleveland district. The new address of the school will be 2261 E. 14th St., Cleveland.

Welding Practice in the Aircraft Industry

Selection of Equipment—Materials—Requirements of the Weld—Procedure Control—Duties of the Supervisor

By J. F. Hardecker† and Edwin A. Joyce††

WHEN we consider that we have in the United States upward of 16,000 miles of airways, on which planes covered in the first six months of 1928 nearly 3,350,000 miles, there is no question but what aviation in the United States has arrived as an industry. Of the part played by welding there also can be no question, the vast majority of planes are using welded steel tubing fuselages, tail surfaces, landing gears, tail skids and fittings. The growing application of welding in several industries has forced the development of small, light-weight equipment and skilled mechanics in the handling of the oxy-acetylene torch, a factor which

Fuselage of Keystone "Patrician." An Example of Welded Steel and Riveted Duraluminum.

the aircraft industry was quick to see the advantage of. Nevertheless, there is a certain technique to aircraft welding, which though intimately related to the practices of other industries, still needs to be followed for proper results, for in no other industry is the perfect weld so absolutely essential as it is in airplane manufacture.

While this article will deal primarily with actual shop processes of acetylene welding the part played by the designer in co-operation with the welding personnel should not be overlooked. Nor should the value of laboratory tests, metallurgical examination, and the usual process of trial and error followed by rigid tests, be minimized. All these and many other factors have exerted a considerable influence on the development of the art of aircraft welding.

Equipment

Gas regulators should be capable of retaining the working pressure constantly until the initial pressure closely approaches the working pressure. The difference between the gauge working pressures with the torch valve open and closed should be small so that little time is lost in adjusting the proper flame. The general range of pressure gauges found most desirable is for oxygen 0-3000 pounds for high pressure and 0-50 pounds for working pressure, while for acetylene a high presure of 0-350 pounds and a working pressure of 0-30 pounds are most suitable.

The welding torch should properly mix the gases, be light in weight and well balanced to the hand. It should be provided with proper valve mechanism to enable the operator to obtain secondary gas pressure adjustments and shut off during the welding operation. They should always be operated at the pressures specified by the manufacturer. Valve stem packing and hose connections should be tight at all times.

Welded Tubular Steel Landing Gear.

For connecting the gas supply with the welding torch, $\frac{3}{16}$ inch diameter rubber tubing, being the lightest durable hose available, is preferable. Long lengths of hose should be avoided, but where this is not possible, heavy weight $\frac{1}{8}$ inch hose should be used except for the last ten to fifteen feet connecting to the torch. Hose connections to torches and regulators must of course be securely fastened and gas tight.

The recommended drill size for welding tips for different thicknesses of metal is shown in Table I. If the blow pipe should become obstructed in any way, a soft copper or brass wire or a hardwood reamer should be used to clean it out. The use of hard sharp tools which will enlarge the orifice should be avoided. The end of the copper or brass wire should be rounded off so that there are no sharp edges to scratch the passageway. Periodic inspection of tips by gauging is recommended, so that enlarged orifices may be remarked to the proper size.

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*Photos by courtesy of the Keystone Aircraft Corp. of Bristol, Pa.

†Chief Draftsman, U. S. Naval Aircraft Factory.

††Associate Metallurgist, U. S. Naval Aircraft Factory.

Materials

Only two types of steel need be regarded at the present time as having sufficient application in aircraft welding to warrant their consideration. The first of these is a mild carbon steel (S.A.E. 1025), which is rapidly being supplanted by chrome molybdenum steel (S.A.E. 4130X). The first has a tensile strength of 55,000 pounds per square inch, while the latter has 95,000 pounds per square inch and is capable of 200,000 pounds per square inch under proper heat treatment.

TABLE I

Thickness of Base metal (inches)	Drill sizes of welding tips for the various thicknesses of base metal (range)	Gap spacing after tacking
1/64 (.0156)	No. 78	1/32
1/32 (.0312)	No. 71	3/64
3/64 (.0468)	No. 61	1/16
1/16 (.0625)	No. 57	
5/64 (.0781)	No. 56	
3/32 (.0937)		
7/64 (.1093)		

Many types of welding rod have been used, but the prevailing type is one having a composition of carbon 0.10 to 0.18, manganese 0.40 to 0.60 and a maximum of phosphorus and sulphur of 0.040.

Other welding wires, including alloy wire, have been used, and the above recommendation should not be construed as precluding their use.

Aircraft Welding Requirements

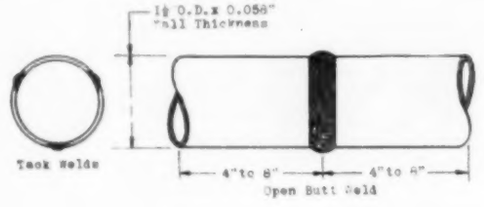
In order to better present the details of desirable welding practice in aircraft, a few typical weld details will be analyzed. These present the ideal to be striven for, but it is thoroughly realized that reasonable tolerances must be applied in actual practice. For this and other information in this article, grateful acknowledgment is made to the joint report of the American Bureau of Welding and the Committee on Welding Procedure entitled "General Procedure Control for Oxy-Acetylene Welding."

A simple open butt weld is illustrated in Fig. 1. The ends should be cut square and cleaned inside and out past the width to be welded. Before regular welding, tack welds, 1/8 inch to 1/4 inch long should be applied at three equidistant points. The tubes should be rotated while welding. The reinforcement should have a range from 1/8 inch to 1/8 inch thick, and penetration should be full to the inside wall.

A seam butt weld is illustrated in Fig. 2. The edges should be cut square, the surface of the edges ground or filed off if cut with the oxy-acetylene torch. Surfaces of the tube to be welded are to be thoroughly cleaned of oxides and foreign matter. Tack welds 3/16 inch to 1/4 inch long should be used where marked. The tube should be secured in a vertical position, and the welding progress vertically upward, starting from the bottom.

A fillet weld is shown in Fig. 3. The edge of the plate abutting the tube should have a square cut. Tack welds 3/16 inch to 1/4 inch long should be applied to both sides near the ends of the plate. The tube should be clamped to the table so that the welds can be made in a horizontal position. Penetration should be to the root of the fillet or to the point marked "X".

An inset plate weld is detailed in Fig. 4. As before the edges should be cut square and properly cleaned. Tack welding should be accomplished by placing four tack welds, two each side, near the end of the plate at the point of the fillet welds, and two tack welds near the ends of the plate at the point of the butt weld. The parts are to be placed in convenient position for each of the three welds. Welding may be done forward or backward, but the backward is recommended. Penetration is to be to the point marked "X".



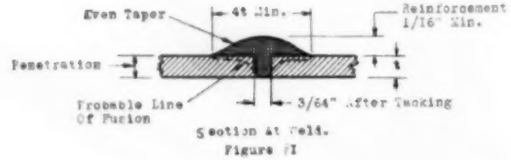


Figure #1

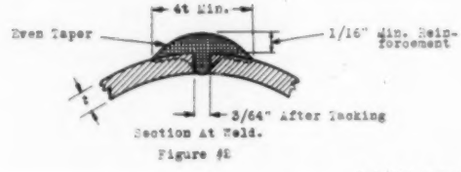


Figure #2

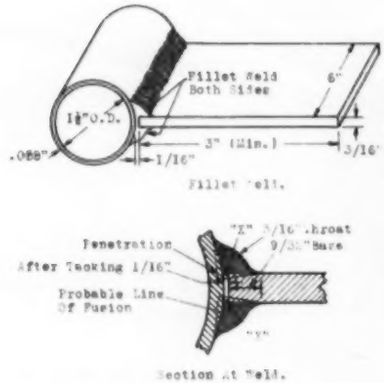


Figure #3

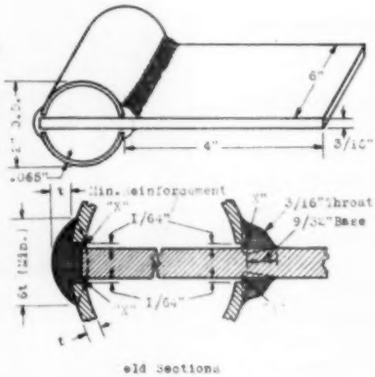


Figure #4

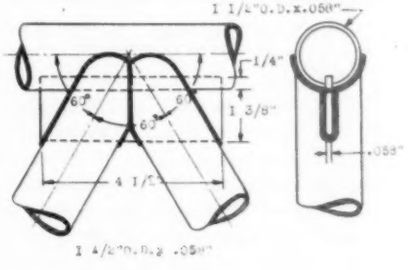


Figure #5

Other welding wires, including alloy wire, have been used, and the above recommendation should not be construed as precluding their use.

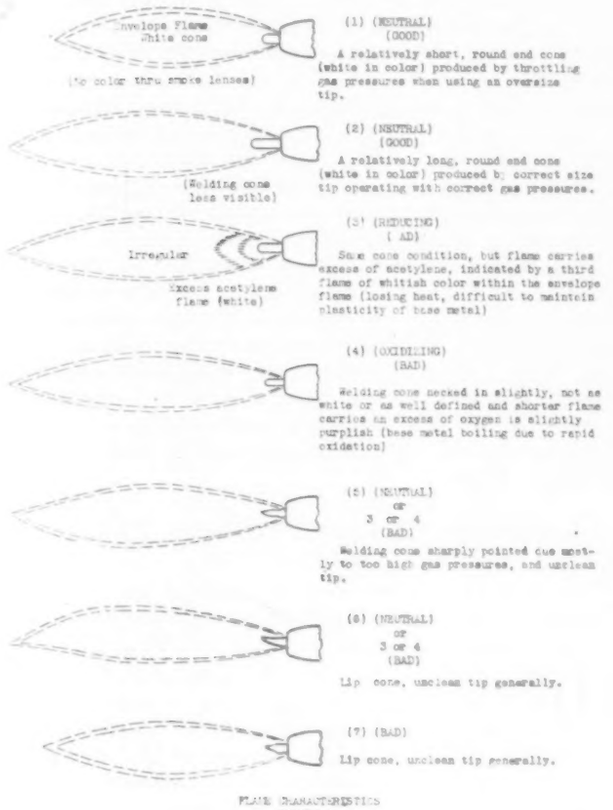
An intersecting tube weld is shown in Fig. 5. Intersections must be carefully matched. Tack welds 3/16 inch to 1/4 inch to be used where marked. The job is to be welded in a fixed position; inserting the plate vertical with the principal member uppermost. Direction of weld is optional, with backward preferred. Penetration is to be to the root of the fillet.

Procedure Control

A clean welding tip, with a soft neutral flame, neither pointed nor irregular is desirable. An analysis of flame characteristics is given in Fig. 6. Penetration of weld to the inside of the tube or to the points marked "X", without excessive weld material protruding into the inside of the tube, is an indication of a good weld.

Even fusion into the base metal, with the "floating out" of oxides or any dirt in the weld puddle is essential. The regular movement of the welding torch, with an occasional check for neutral flame is a basic requirement. There should be a uniform incorporation of fillet material with the progressing weld puddle, and the maintenance of clean, molten metal at all times during the welding operation.

The weld contour should be regular and the weld should taper evenly as previously illustrated. The tack welds should be properly


Envelope Flame
White cone
(No color thru smoke lenses)
(1) (NEUTRAL)
(GOOD)
A relatively short, round end cone (white in color) produced by throttling gas pressures when using an oversize tip.
(Welding cone less visible)
(2) (NEUTRAL)
(GOOD)
A relatively long, round end cone (white in color) produced by correct size tip operating with correct gas pressures.
Irregular
Excess acetylene flame (white)
(3) (REDUCING)
(BAD)
Same cone condition, but flame carries excess of acetylene, indicated by a third flame of whitish color within the envelope flame (losing heat, difficult to maintain elasticity of base metal)
(4) (OXIDIZING)
(BAD)
Welding cone necked in slightly, not as white or as well defined and shorter flame carries an excess of oxygen is slightly purplish (base metal boiling due to rapid oxidation)
(5) (NEUTRAL)
OR
3 OR 4
(BAD)
Welding cone sharply pointed due mostly to too high gas pressures, and unclean tip.
(6) (NEUTRAL)
OR
3 OR 4
(BAD)
Lip cone, unclean tip generally.
(7) (BAD)
Lip cone, unclean tip generally.

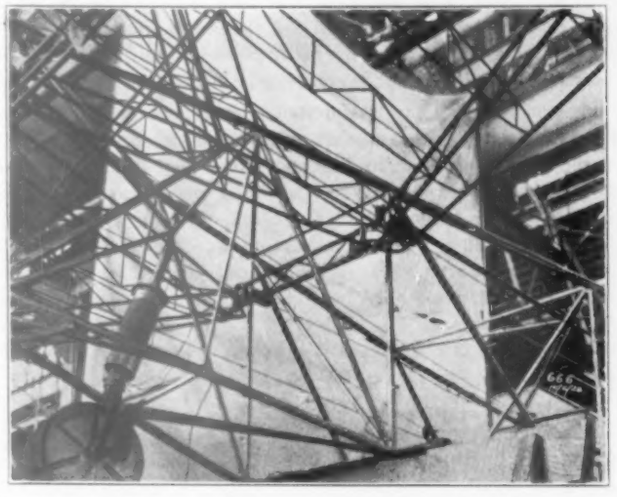
FLAME CHARACTERISTICS
FIGURE 6.

incorporated into the final weld, with good fusion at these points. The weld must be thoroughly "closed out" at the finish where the progressing weld engages the start of the weld, to make certain that the weld is thoroughly penetrated into the previously made weld. The best way to insure this is to reheat the weld zone about one inch beyond the closure point.

Care in preparation and setting up of a job is very essential in the making the more difficult welded joints, such as are made on thin walled tubing. Thorough preparation reduces many otherwise difficult jobs to simple welding and thus reduces materially the risk of failure. Production work should not be attempted without suitable jigs and the more complicated the work the more essential are such fixtures. In welding such members as are made up of a number of parts, suitable jigs not only help the welder in holding the various parts in their proper alignment, but also increase the speed and ease of welding to a marked extent. Work on such assemblies requires great skill, for the operator is required to weld joints in all positions and of all types. Such work is usually allotted to those welders who have shown aptitude on more simple welds on bench work. The design of jigs should be given careful attention. The "set up" is just as important in welding as in machining operations and cleverness in this detail is one of the ear marks of a good welder. In fact, a large part of the training of a welder is devoted to acquiring skill in preparation of work.

In some plants where a number of welders are employed, each is required to successfully pass a course of instruction, and after going on production work is required to submit samples of welds which when tested to destruction must be satisfactory or the welder is "degraded" to the beginners' class for further schooling.

Although it is quite true that there are no accurate methods for determining the quality of a weld without resorting to destructive tests, the same criticism was at one time felt toward riveed joints because likewise no methods were available for determining the quality of the rivets. However, satisfactory performance in service is the gauge which determines the extent of use of any particular method of joining metals. Careful inspection will eliminate most



Suction of the Fuselage of Keystone "Patrician" Showing Variety of Welds Required.

of the defective welds and such inspection may well include the following non-destructive methods:

(a) Visual inspection for shape and contour which may well be supplemented by the use of gauges.

(b) Periodic qualifications of the welder. This has already been referred to, but is repeated because it is probably the most important of all practical methods.

THE STEAM RAILWAY FIELD*

The oxy-acetylene operations that can be carried on profitably on steam railways are to a great extent standardized by long usage under uniform conditions and in connection with railroad equipment that is fundamentally uniform. Therefore the most notable progress in recent years is not in the discovery of new applications and methods, but pertains to a wider adoption of the known oxy-acetylene operations by many railroads that formerly were more or less skeptical about the economy or the practicability of these specific operations.

There can be no question that welding and cutting has advanced in extent and quality in the past three or four years, partly as a result of improved methods and equipment and partly because of the availability of more proficient operators. It is worth nothing that while in the industrial field an operator is generally a specialist on a limited class of work, such as pipe welding or sheet metal work, in railway work the operator is not a frame welder or a cylinder welder, but a general welder who must be experienced on all classes of work.

The oxy-acetylene industry has encouraged this progress, by helping the railroads to train their operators, by showing them improved methods and safe and economical practices and by assisting them in the maintenance of their oxy-acetylene equipment, and it is the industry's obligation to continue this practice. It would be impossible to estimate the exact contribution of oxy-acetylene welding and cutting to present-day improved efficiency in general railway operation as represented by increased locomotive and freight car turnover, but

*Reprinted from the Report of the Oxy-Acetylene Committee of the International Acetylene Association, 1928.

observation of the process in any railway shop will convince us that it is very largely responsible for speeding up repairs to locomotives and rolling stock that formerly were kept out of service for longer periods.

It is impossible to consider extensive reclamation in the Stores Department without thinking of the welding and cutting torch. It may be trite to say that there are innumerable parts which can be restored to usefulness by the building up of worn surfaces at comparatively small cost and which would otherwise have to be disposed of at their scrap value, but when such reclamation is applied to the enormous quantity of worn or broken material that normally accumulates on all of the railroads in the country, the saving is incalculable.

Progress in railway maintenance early proved the advisability of welding locomotive frames, deck castings, wheel centers, wheel tires with flat spots or sharp flanges, bumper beams and other heavy parts which were formerly scrapped or removed and handled in the blacksmith shop, until today the removal of a frame, the scrapping of a deck casting or other similar parts to be scrapped or repaired in the blacksmith shop is done only in remote cases and then only because of a lack of knowledge of the oxy-acetylene process which unfortunately prevails in some instances. This also applied to the passenger or freight car.

Standard operations on locomotives today might be classified as the welding and reclamation of such important parts as the cylinder which becomes cracked, scored and sections broken out caused by water or accidents, frames including the welding of broken sections, lenghtening where a change is made in the boiler or increased wheel space is required, the building up of worn spots caused by spring saddles, spring hangers, worn binders especially in the jaws, broken hanger pins, hanger and rigging, side main and connection rods particularly front end of main-rods, cross heads, cross head shoes and gibs, cross head guides, valve motion parts worn or broken, piston rod for cross head fit, piston heads which are built up with bronze, air pumps, air pump cylinder lugs and accessories, air pump piston heads, welding of air, steam and lubricating pipes on the locomotive, lubrication fountain heads, welding of locomotive cabs, cab trimmings, welding of new and building up worn fire box sheets, welding of grates, grate rests, ash pan and appurtenances, safe ending of flues, cutting off of new staybolts and the removal of old staybolts and fire boxes. Such briefly is a partial list of the many profitable applications of the oxy-acetylene process to the locomotive.

This progress has included the introduction of many novel applications of the oxy-acetylene process in the tool room and other departments for use in building up and reclaiming dies, jigs, drills, and in the manufacture of special tools. Lathe tools are produced at a reduced cost by the use of ordinary steel shanks made from scrap material, which are forged to shape and tipped or built up with the torch using a recently developed special steel welding rod. This rod is also used on lathe centers and other parts subject to the severe abrasion.

Development in the Car Shop has made rapid strides, and there are now in service completely welded steel hopper coal, gondola and tank cars. This is a recent introduction and offers great possibilities for economy in manufacture, maintenance and repair. Welded seams reduce the weight of the car, facilitate unloading, and it is presumed will materially increase the life of the car, which will undoubtedly be proven by the specimens of each type now in operation.

The maintenance and repair of steel passenger coaches is greatly facilitated by the welding in of sections and entire new sheets or other parts.

Many large railroads have adopted and classified as standard the welding and building up of couplers, coupler knuckles, draft rigging, striking plates, truck frames, truck pedestals, journal boxes, journal collars, center plates and center and side sills, air piping, and other incidental parts, and body repairs as above mentioned.

The acceptance of the fact by the major railroads that the reconditioning of rail joints with the oxy-acetylene process should be considered good practice and the most economical method of reconditioning rail for renewal in the track has prompted the continued interest of railroads in this very practical method of doing this work, which has resulted in the regular practice of welding thousands of rail joints each year in addition to the reclamation of cross-over frogs, crossings, switch points, cutting off of rails to length, removal of joint bolts and angle bars for relaying purposes; also the welding and reclamation of switch stands, tie bars and miscellaneous appurtenances.

In the Signal Department the practice is extensively used for the application of the signal and propulsion bonds.

A recent application to the reclamation of hump retarder parts has greatly facilitated maintenance of this innovation for the handling of cars while in classification yards.

The Bridge and Building and Water Service Departments have received considerable attention, with the resultant increased efficiency in the installation of new work as well as the maintenance of existing pipe lines, water tanks, water treating plants and similar equipment. Welding of pipe lines is rapidly increasing and has been adopted as a standard on a number of railroads which have established permanent welding organizations to handle all replacement work and the installation of new.

LINCOLN WELDING SCHOOL EXPANDS FACILITIES

To meet the rapidly increasing demand for practical instruction in arc welding, the welding school maintained by the Lincoln Electric Company is greatly expanding its facilities.

While students of the school are carefully selected as to seriousness of purpose, officials of the company state that it will probably be necessary to more than double the amount of welding equipment before the end of the current year. At present there is a waiting list of constantly increasing length and it is to take care of the urgent demand by manufacturers for more skilled arc welders that the present expansion is being made.

It is doubtful if any other industry offers instruction on quite the same basis as does the welding industry. No tuition is charged at the Lincoln School and any ambitious mechanic is free to take the course up to the capacity of the school.

The course is of six weeks duration and is intensely practical in character. Students are required to conform to ordinary shop rules and must keep the conventional shop hours.

The progress of an individual student is limited only by his own aptitude and application since individual rather than class instruction is given.

It frequently happens that experienced arc welders will spend from a week to ten days in a sort of extra curricular course to learn special work where they feel their experience to be insufficient for a contemplated project.

Manufacturers who have redesigned their product for arc welded steel construction are sending picked men to welding school both to learn the process and to learn to supervise and inspect arc welding operations.

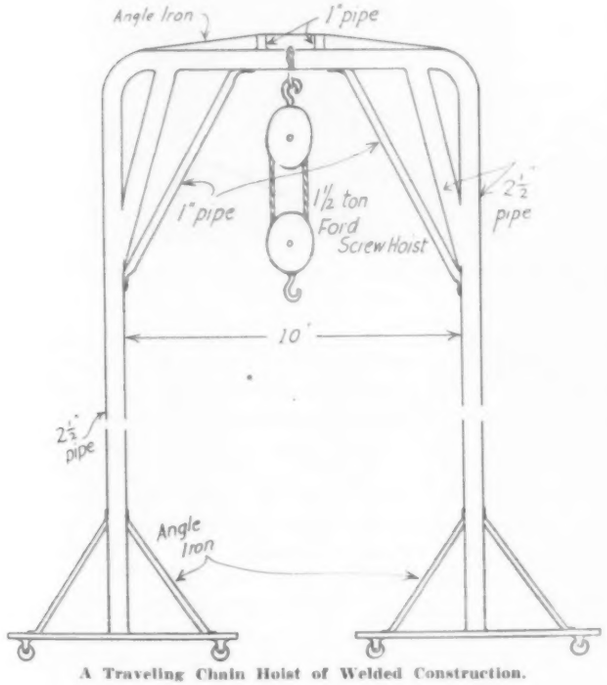
The Lincoln Welding School is under the direct supervision of Arthur E. Madson. Mr. Madson thoroughly knows his subjects and is also able to impart his knowledge to others. His practical experience in every sort of welding method plus experience in teaching in one of the country's largest trade schools make him unusually fit for the work which he has chosen.

Hints for the Welder

WHEN YOU FIND a new way to do a hard job, or finish a particularly interesting weld, can you describe how the work was done? . . . . . Have you learned some little stunt every welder ought to know? . . . . . Write to us about these things . . . . . This department helps you welders to help each other. Write up your ideas any old way and just make rough pencil sketches . . . . We'll fix them up for publication.

FOR HANDLING HEAVY JOBS

It is not unusual for a welding shop to receive large, heavy castings which are out of service on account of small breaks. It very often happens that more time is consumed in handling such a job than actually making the repair, particularly in cases where a number of things have to be moved around in the shop to make room for it. Sometimes the welding shop can be equipped with an overhead traveling crane, which makes it possible to run a chain hoist out over the body of a delivery



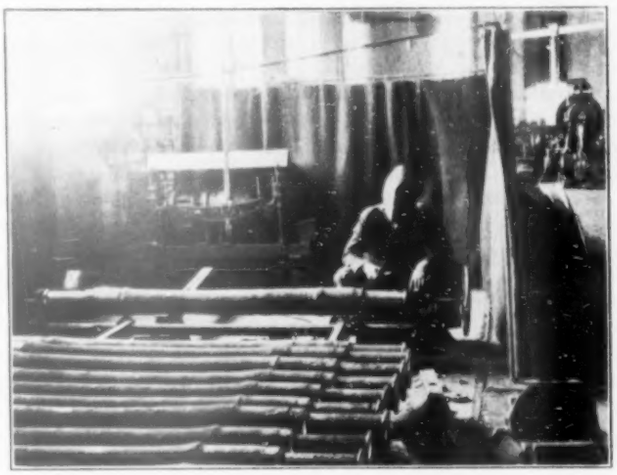
A Traveling Chain Hoist of Welded Construction.

truck and unload such pieces very quickly, and occasionally a welding shop will be found equipped with an overhead system which will have the same movement in two directions. But there are not many cases where such an arrangment is practicable. In the Pallady Welding Works, Portland, Oregon, this problem is solved by the construction of a traveling chain hoist, shown in the sketch. This is made of a few pieces of 2½-inch tubing and 1-inch pipe and angle irons. All of the parts are easily formed in the welding shop and the whole frame work is assembled by welding. It is built high enough and wide enough so that it can be slipped right over the body of an ordinary truck, then after the piece is unloaded it can be wheeled away in any desired direction. In the sketch, the bottom members have been turned around so that the arrangement of the rollers can be clearly seen. The outfit is also very useful for handling heavy castings which are being preheated in a charcoal fire.

WELDING COLLAR ON CAR JOURNALS

In building up defective spots in the collars of car journals, or similar material which must be turned frequently while in process of welding, an easy method of turning is essential to fast work. Here is a welding booth equipped for easy operation by the welder alone. The journals to be built up are loaded upon a track, made of two old rails spiked upon wooden blocks, just outside the booth.

Inside the booth a similar section of rail, a couple of inches



Welder Using Simple Apparatus for Repairing Car Journals.

longer than the journals, is placed crosswise, on blocks. A piece of 1 by 4 steel, 10 inches long, is bolted to each end of this rail, by holes through one end, which is forged at right angles for about two inches. Near the top of one of these vertical bars a dead center is welded on, to fit in the center of the axle end. In the other one a screw bolt, with an old brake wheel secured to the end, centers in the axle. The journals, after rolling down the storage track and into the centering points, being tightened by the brake wheel, are easily rolled over with one hand as the welding proceeds. When finished they are rolled upon two low iron horses just behind the welder, to await the labor gang to remove them.

INTERESTING BRONZE WELDING REPAIR

An interesting application of the bronze welding process which has recently been completed at the plant of a British starch refining company convinced the superintendent of that establishment of the value of a welder and oxy-acetylene welding equipment.

The head of the condenser used in the refining process suffered an eighteen inch break, and it looked very much as if a serious loss would result. This condenser head was an intricate casting, and would have been very costly to replace. To repair it, it was decided to preheat and bronze weld.

Under ordinary conditions it is considered unnecessary to preheat in bronze welding. Owing to the design of this job

and the size, however, this extra precaution was taken. A furnace of loose firebrick was built up. The condenser head was placed at the center, the base resting on two six-inch pipes. The crack was thoroughly cleaned with a stiff wire brush and a charcoal fire lit under the casting. The casting was covered with an asbestos paper and allowed to come to an even temperature.

Bronze welding was then effected, using a high-grade bronze rod and a good quality of flux to float off the impurities. After the weld had been completed the casting was allowed to remain in the furnace in a dying fire so that cooling would be gradual and uniform. The repair was a complete success and a lasting testimonial to the process.

BROKEN ALUMINUM AIRPLANE ENGINE REPAIR WELDED

Most welders will admit that the welding of broken aluminum castings is a difficult job requiring great care in the manipulation of the torch and the fusion of the welding wire and the base metal. Experience with the action of this metal is necessary before the welder dare do a job which he must absolutely guarantee to hold, such as welding an aluminum airplane engine. The Acme Welding & Cutting Co. of Chicago recently successfully completed such a job on an eight-cylinder V-type airplane engine. The aluminum casting of the engine had cracked in about a dozen places around one of the end cylinders while the plane was in flight, causing a forced landing which fortunately was made without further damage. The engine was removed from the plane and sent to the above mentioned welding firm which accepted the job along with the rest of their work. The cylinders and pistons were removed from the engine, but the cam shaft and crank shaft were left in. In preparation for welding the cracks were ground out and in three cases where there were ribs under the parts to be welded, adjacent pieces were removed so that the welder could build up on the inside and so retain the original strength of the casting. The cam-shaft and crank-shaft were wrapped in wet asbestos before starting the actual welding operation, and they were kept wet throughout the job. The work was done with the acetylene torch using a drawn aluminum rod for filler instead of the usual cast rod. The man who did the job accredited much of his success in that kind of work to the liberal use of a good flux.

As to the actual procedure of the welding, this was done rapidly a few inches at a time with a defective cylinder bolted in place to maintain the position of the pieces. This job required absolute accuracy of alignment, as there were some nine bolt holes near the cracks which had to be in their original positions. When the welding was completed the welds were ground off where necessary, and much to the satisfaction of everyone, there were no checks or cracks to be seen in any of the repaired places.

A PROTECTION FOR SHOP EXTENSION LIGHTS

Most electric arc welders who use the arc on repair jobs in dark places are acquainted with the fact that it is not safe to leave an electric light bulb too close to the scene of operations. The sparks flying from the welding job and striking the bulb often cause it to burst at very inopportune times, causing delay in inspecting the work and the trouble and expense of replacing the bulb. There is also the element of danger from the flying glass to be considered. In order to avoid these troubles and still have the use of their extension lights, The Acme Welding & Cutting Co. of Chicago protect their bulbs by enclosing them in small glass containers about the size of a one pint Mason jar. Such a thing is easy to construct. Just drill a hole in the lid of the container, put your drop-cord through, attach the socket, screw in your bulb, put the lid on and you are all set. Solder your socket tight to the lid so that the bulb will be held rigidly in the container and will not rattle around. This sort of a protector is also advisable around any work which causes flying particles, such as in grinding or using the cutting torch.

A PRODUCTION JOB FOR THE CONTRACT WELDING SHOP

The side porch will soon be popular again, for Summer is just around the corner. Already, folks are beginning to anticipate pleasant afternoons spent in this sanctuary away from the broiling sun, or cool evenings screened from flies and mosquitoes, content with a good book or perchance in the society of congenial companions.

The setting would not be complete without the ever popular porch swing. This necessary piece of furniture can be

All Welded Porch Swing Constructed by a Job Welder.

purchased at almost any sporting goods or furniture store. The sturdiest type of swing, however, is one that may be constructed by the local job welder at a cost which will compare quite favorably with the standard store product.

A progressive job welding shop in the Mid-West, ever on the alert to increase business and to create production jobs, has built up a nice business in the manufacture and sale of these swings. This firm's success should prove an incentive to other contract welding proprietors who are ambitious to increase their business along production lines.

The swings are made with screw connections welded to end supports and top cross bar, so these parts may be taken down and readily reassembled. The cross bar and A-shaped supports are made from 2-in. steel pipe cut with the cutting blowpipe and welded at all connections. This makes for simplicity of construction and provides all the strength needed to meet the loads and the vibration of swinging.

Lengths of light pipe, bolted near the top of the hammock legs, act as removable supports for the awning. Heating in the blowpipe flame and hammering insures a flat surface for bolting, and through this the cutting blowpipe readily sinks a bolt hole.

Seat frames are made from 1-in. pipe. To form the back, strips of 2-in. flat iron are welded in at intervals of 8-in. The same material is run lengthwise to form the seat and is supported by a cross bar welded at the center.

A complete swing can be built by one welder in a day. The labor and material costs are such that a nice profit for each swing may be realized. The finished article presents a neat and sturdy appearance and has proved a great seller to the welding shop which introduced it.

ACTION IN PHONE BOOK ADS

The Welder who considers using, in addition to a mere listing, a display advertisement in the classified section of the telephone directory, will find it advantageous to include action elements in his ad. Unlike many forms of publicity, the directory ad may remain dormant for weeks at a time. Only when a person, desiring welding service, looks into the classified section to select what company to call, does the advertisement have an opportunity to present its message. Hence there must be enough latent energy—action held in abeyance—to cause the message to spring out when a prospective customer opens to the page on which it is printed.

Action Pictured in an Advertisement Arrests the Attention of the Reader and Matches the Prospective Customer's "Do It Now" Attitude.

The prospect generally is motivated by an action element himself. Usually he is in a big hurry; so the directory advertisement should reflect similar hurriedness. In other words, the action element in the advertisement must match the action element which moves the customer.

An examination of the telephone directories shows that some firms already are including the action element in their ads, but not to the extent that some of the other lines of business are following.

Take the Ad of the Turner Welding Company, El Paso, Tex., for example. About one-third of the space is taken up by a pen and ink sketch of a welder "doing his stuff" by the side of a huge wheel. It is an action picture and it harmonizes, no doubt, with a picture in the prospect's conscious or sub-conscious mind. He has a bit of machinery, perhaps a huge wheel, that must be welded. Since the two pictures harmonize, we may well suppose that he will obey the impulse and call the telephone number which is so prominently displayed in connection with the picture.

There is also a second action element in the ad. It is contained in the use of some lettering of script or Italic design. Script lettering arouses a conscious or sub-conscious picture of a hand with pen or pencil moving across the page. Italics are somewhat similar, though not to the same degree.

The Ad of the Blanchette Welding Company of Denver, Colo., also contains a picture of a welder at work, though it is not quite evident what the job is. However, it is an action element and the phone numbers are tied closely to the picture so there is no escaping them, once the prospect has met the action element in the ad. The Smith Welding Company, also of Denver, illustrate the ad with a picture of a welding job under way.

A study of the action elements in telephone directory advertising in general leads one to conclude that the welding trade has not taken advantage of all of the opportunities. So, for the benefit of any of the trade who desire to include more of such elements in their ads, we list the various methods that are frequently used.

1st—Using pictures which harmonize with the prospect's mental pictures: (A) a picture of the service being rendered; (B) a picture of the shop in which the service is rendered; and (C) a picture of the service after it is concluded.

2nd—By using some script or Italic lettering.

3rd—By using designs containing action elements such as a rising sun, or the unfolding of a scroll.

4th—By presenting portions of the message slantwise or so that they describe gentle curves. Curves usually contain more action than straight horizontal lines.

5th—By using arrows to indicate or to connect important features of the advertisement. A straight arrow contains some action; a straight arrow indicated as being in flight, contains more action; a curved arrow contains the most action.

6th—By giving such words as "Rush," "Quick," etc., the appearance of flying through space by running horizontal lines through the letters and toward the rear.

7th—By illustrating the telephone number by a picture of the phone; a picture of it being used; or a picture of the instrument in two hands, one of which is about to lift the receiver from the hook.

8th—By using illustrations of animate or inanimate objects in action—preferably something associated with the business.

A USE FOR CARBON PASTE

Repair of metal parts by welding is common practice today and the oxy-acetylene process is saving many valuable dollars which formerly went into the purchase of replacements.

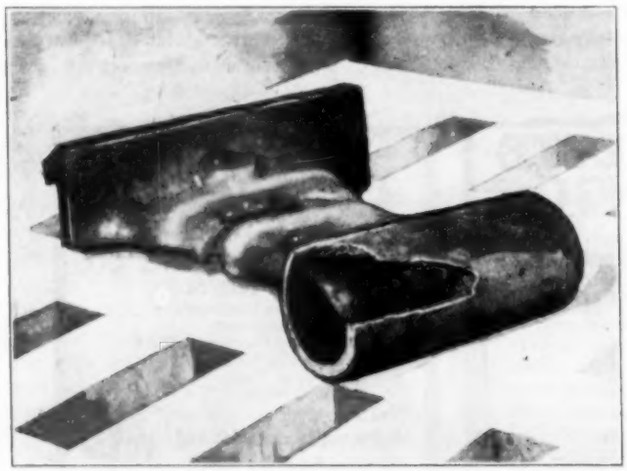
Now, when a casting is broken or defective, the damage is quickly remedied by the welding blowpipe. The same applies to a machine part or any metal piece which may have suffered a crack or complete fracture. When all of the broken parts are saved and delivered to the plant welder for repair, the job is comparatively simple, but when pieces are missing it is necessary to build up the missing sections with a filler core which will resist the heat of the welding flame. This is accomplished by using carbon paste.

The following description of the use of carbon paste shows the method employed on a casting where a piece was missing. The illustration shows a cast iron support for a drill table. The break is first filled with carbon paste, which is smoothed to shape with a putty knife. It is necessary that the paste be packed in tightly so that the molten metal will stay where it is intended, thus saving considerable effort in grinding and machining after welding is finished.

Near the center of this casing is a ¼ in. threaded hole for a set screw, part of which was broken out. This hole is carefully filled, and after the welding is finished it is usually necessary only to rethread the hole. If carbon paste or carbon rod

is not used for this purpose new holes must be redrilled and tapped.

After the welding is completed the piece is annealed, and when cold the carbon paste is easily removed. The inside of the weld will be found to possess the correct contour and little or no finishing should be necessary.

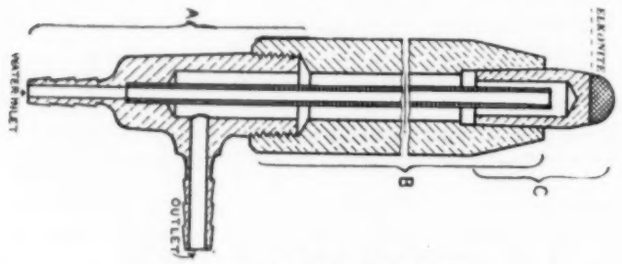


A Cast Iron Support-Carbon Paste Was Used to Obtain Proper Shape When Welded.

ELKON PRODUCES NEW SPOT WELDING TIP

Resistance welding has taken another step forward with the recent development of a replaceable tip electrode for spot welding machines.

This new device—a product of Elkon, Inc., Division of



Drawing of New Spot Welding Tip.

P. R. Mallory & Co., Inc., New York City—is already in use in the welding department of a large automobile body building corporation in Detroit. Performance records there show that more than 250 spot welds per minute are possible. The tip will stand up almost eight hours without redressing. The welding end of the tip is made of Elkonite, an alloy which has, during the past two years, been used extensively by many large units of the Automotive Industries. Because of the exceptionally long life of Elkonite it has been found unnecessary to make the whole tip of that alloy but only a small section of the welding end of the tip, which part is autogenously welded to the shank of copper.

The success of this new device was made possible through the development of a water cooling system which runs practically to the end of the tip assuring cool operation at all times. The accompanying diagram shows the complete outfit. The Elkonite Replaceable Tip (C) is formed with a taper to fit into the copper electrode holder (B). The water cooling attachment (A) which is made of brass, screws into the electrode holder and has an inlet and outlet for the water.

The value of this new development lies in its improved water cooling system which permits continuous operation for long intervals. Also, when replacement of the electrodes becomes necessary, **the tip only** is changed and the original electrode holder remains in service indefinitely. This latter represents a decided economy over the old method.

From present indications, this new development bids fair to not only increase production and lower costs but also to encourage many new spot welding applications heretofore impractical commercially.

DEMONSTRATION OF TENSION TESTING OF WELDS

Southwark Foundry & Machine Company, Philadelphia, Pa., have established at their plant an operating exhibit of the newest forms of testing machines for tensile and transverse

Weld Testing Machine in Use. Note Dials Which Indicate Loads.

tests of welds. All the apparatus is equipped with dials for the continuous indication of loads and with a new electric multiple range recorded for obtaining accurate test curves. This equipment with recorder is shown on the attached photograph.

The human element is entirely eliminated by this method of electric recording so that an unbiased comparison of quality of welds can be charted continuously for subsequent study and comparison.

This company invites engineers interested in the testing of welds to visit this laboratory and to discuss the new methods presented.

Southwark Foundry & Machine Company will be glad to make tests on any samples presented and to advise as to the characteristics of the weld from the resulting charts.

This laboratory is established as a co-operative measure. The Southwark Company is a user of welding equipment and employs both electric and gas welding to a large extent in certain kinds of work. This laboratory was the outgrowth of a testing program for their own welds, wherein a comparative study of gas and electric welds for particular jobs was undertaken.

This demonstration laboratory will be open to visitors at any time and an invitation is extended to all interested engineers to visit this plant.

STOODY PURCHASES LARGE TUNGSTEN DEPOSIT

Report has been received that the Stoody Company, Whittier, California, manufacturers of hard facing materials, have purchased a deposit of tungsten in Arizona and have started installing the necessary equipment to mine and refine it. This deposit is reputed to be one the largest single deposits which has been located and promises to yield an ample source of supply of tungsten indefinitely. This element is an important constituent of many hard facing substances.

Welded Oil Line in the Caucasus

American Firm Takes Hand in the Construction of a 570-Mile Pipe Line from Baku Oil Wells to the Black Sea

By A. A. Heller*

BAKU, on the Caspian Sea, is one of the greatest oil producing centers of the world. In the city itself there are so many oil wells that from a distance it looks like a city of miniature pyramids. In the surrounding country, in the sea itself, there seems to be an inexhaustible supply of oil. A trench is dug in the city, or a hole for a foundation or a lamp post, and a new gusher is laid bare. A city dweller may dig a hole in his back yard and find there an everflowing supply of fuel. Since the Soviet Government began working the district many new wells have been brought in and their number is being steadily increased. In 1927 the total drillings exceeded the figure for 1913 by 37 percent. The growth of the Baku oil industry can be summarized in the following table:

Production of Crude Oil in Baku

1924-25	1925-26	1926-27	1927-28
4,737,000	5,586,000	6,893,000	7,573,805 metric tons

The great problem of the moment is to make this huge amount of oil available outside of Baku, for consumption in the interior of the Soviet Union and for sale abroad. In order to make the oil available for export, it has to be carried to the port of Batum on the Black Sea, a distance of some 600 miles, and there delivered to ships that connect Batum across the Black Sea and the Mediterranean with ports all over the world. Baku itself is a port of call for river boats, and some Persian trade, the Caspian being an inland sea and carrying comparatively little traffic.

At the present time Baku oil is shipped to Batum, on the one hand, and to the industrial centers of U. S. S. R. on the other, in tank cars; trainload after trainload of these cars roll along the railways emerging from Baku—one going west to Batum, the other—north and west—to Rostov, Charkov, Moscow, Leningrad and other points.

But these roads cannot accommodate all the oil that needs to be carried; hence the management of "Asneft" (as the Oil Trust of Baku is designated) obtained permission of the Government for the construction of a pipeline from the oil wells at Baku to Batum, the port on the Black Sea.

The laying of this pipe line is now being carried out. The design of the line and management of the work is in the hands of Asneftestroy—a subsidiary of Asneft,—while the execution of the work has been turned over, under contract, to the Russian American Compressed Gas Co. "Ragas." (Ragas is operating in U. S. S. R. as a concession granted the International Oxygen Company of Newark, N. J., in company with the Metalsyndicate of Russia).

The length of the pipe line is about 570 miles. It begins at the Rykov storehouse in Baku, and runs from there in a straight line, as the crow flies, for a distance of some 240 miles to a place called Malai, on the Baku-Batum Railroad, and from Malai on to Batum the pipe line runs along the bed of the railroad, parting from the road for a short distance here and there. The topography of the country is a very difficult one; stretches of trackless desert, swamps, mountains. The climate is also varied; severe wind storms in the desert; freezing weather in the mountains, and tropical heat in the valleys, varying somewhat according to season.

Fig. 1. View of the Caucasus, approaching Batum. Fig. 2. Laying of Pipe. Fig. 3. Types of Native Laborers. Fig. 4. "Ragas" Camp. Fig. 5. Distribution of Pipe by Tractor. Fig. 6. "Ragas" Camp Kitchen.

In the swamp districts, particularly over a stretch of some 120 miles, nothing can live during eight months of the year. Work must be done during the winter months—November to March—as later malaria in most severe form is prevalent. The desert sections are impassable during late Fall and early Spring; and there is too much snow in the mountains in the winter time to permit of any work. Besides the topographic and climatic difficulties, several districts through which the pipe line passes, are roadless, far from any human habitations, and lack water. Nevertheless, the work is laid out and will be finished the coming summer (1929).

The pipe, of the sleeve type, is 10 inches in diameter, with several short sections of 12 inches, in 40 to 45 foot lengths of German, French and Chechoslovak manufacture. The ends overlap a distance of some 2 inches and the welding is being done by oxy-acetylene throughout. In many places the pipe is bent to conform to the contour of the country. There are numerous bridges, viaducts and tunnels to cross, the rise and fall of the pipe in some places reaches 60 degrees.

*International Oxygen Co., Newark, N. J.

"Ragas" undertook this work after about a year's experience in welding an oil pipe line for Grosneft,"—the Oil Trust of Grosny, in northern Caucasus. This was a shorter line, running from the oil district of Grosny to the port of Tuapse, on the Black Sea. This pipe line is 9 inches in diameter and butt welded. The Grosny Tuapse pipe line was completed in November, 1928.

The welding of the Baku-Batum line is carried on in sections, in accordance with conditions of climate, transport, etc. One or more sections is allotted to a brigade or camp, and each brigade must complete its work by a fixed date. There are three camps working at present; toward spring their number will be increased to five or six. A camp may have from 12 to 30 welders and about four times that many laborers. All the welders and foremen are Russians, though some had American experience; a number of them came from the Ragas welding school in Moscow. The laborers are mostly natives of the district where the work is performed.

The camp is quite a complicated organization. A superintendent, or chief, is in charge of the camp, with one or two foremen, an inspector, bookkeeper, paymaster, a transport agent, storekeeper, cook, watchmen, etc. The work day of a welder is six hours. Overtime work is permitted, at rates higher than normal, and only with the consent of the Trade Union Committee. The terms of employment, compensation, dismissal, etc., are strictly regulated by contract with each welder and by a collective agreement with the Trade Union. All the camps are directed and supervised by a central office of Ragas in Baku.

Depending on the location of the camp, the materials and products needed are delivered by freight, or truck, or tractor; or by horses, camels, buffaloes or donkeys—in fact anything animate or inanimate that will pull a load. Oxygen is brought from Ragas' plants at Rostov or Baku (the latter plant being operated by Ragas under lease from Asneft). Carbide comes from Leningrad and welding wire from the Urals. Most of the food products, flour, potatoes, sugar, etc., have to come from a distance, while meat is generally purchased locally. Water for drinking, washing and for the acetylene generators must be carried often a distance of 20 to 30 kilometers.

After the line is traced and the pipe distributed over it, it is the work of Ragas to place the pipe on supports, connect them, clean the interior and weld. Two men turn the pipe, while a third tends the acetylene generator, one of which feeds two welders. The individual pipes are welded in lengths of about 300 feet forming a section; and sections are welded by overhead method by a skilled section welder. The welders spread out over a distance of 2 to 3 miles, and walk 3 to 6 miles to and from camp.

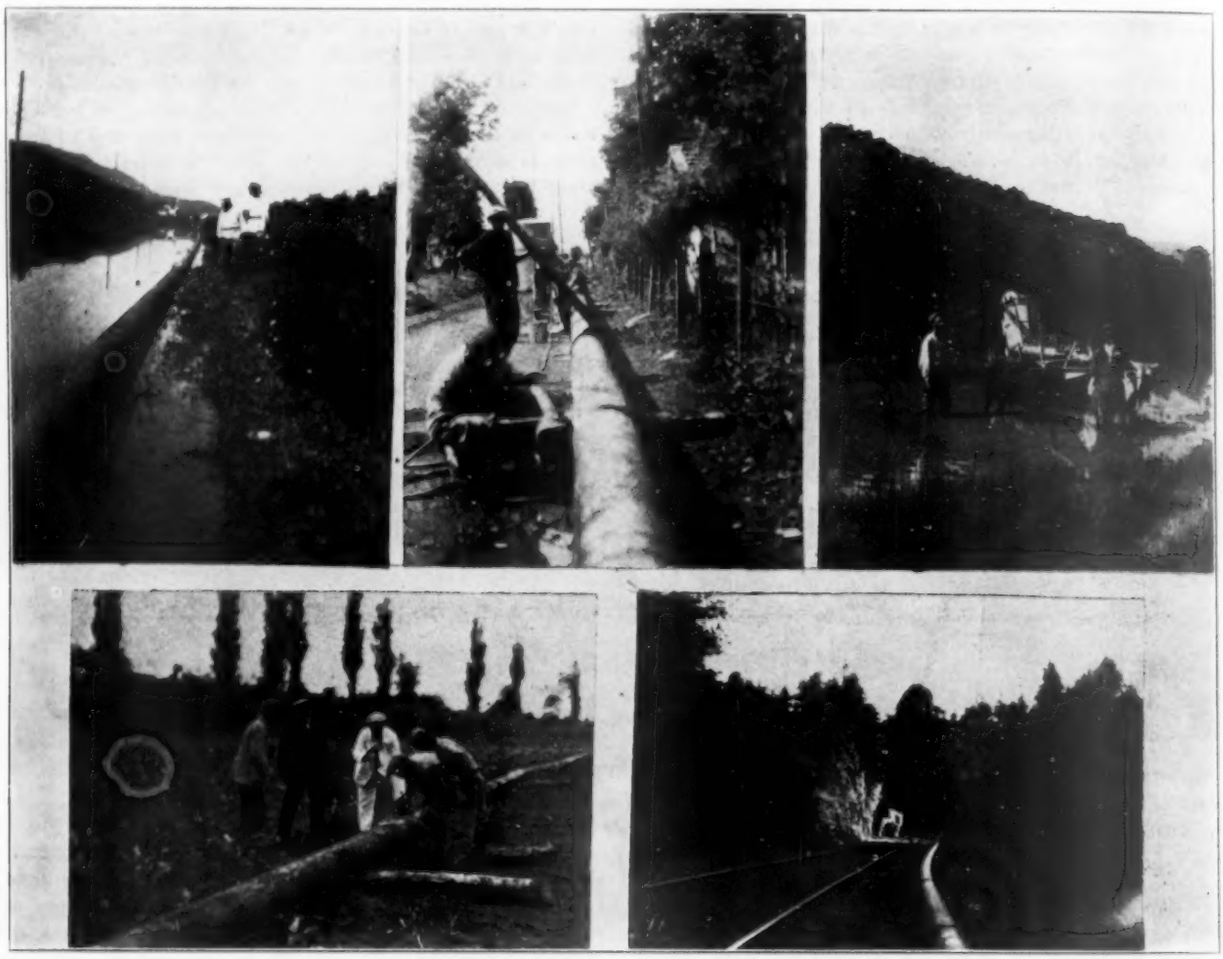


Fig. 7. View of Pipe Line. Fig. 8. Welding Pipe Line (No. 2). Fig. 9. Transporting Equipment Through Swamps. Fig. 10. Welding Pipe Line. Fig. 11. View of Pipe Line (No. 2).

The welded line is tested to 80 atmospheres pressure, painted or covered with tar and buried in a trench below frost line. The trench is dug by American machinery, and a good deal of American machinery is in evidence everywhere, trucks, hoists, as well as part of the welding equipment.

The pipe line will deliver to Batum 1,500,000 tons of oil. There a huge refining plant of latest design is being erected and smaller plants at intermediary points. A great number of holders now grace the hills around Batum, in the midst of luxuriant palms and banana trees. These steel sentinels of industry take their place alongside of ruins of old castles of the Georgian Queen Tamara and her lovers, famous in native song and story.

Welding Service Onto Plow Shares

Tests Show That Standard Steel Plow Shares Which Have Been Stellited Will Stay in the Ground 5½ Times as Long and Remain Sharp

ONCE more the welding torch is coming to the aid of the farmer. Many stories could be told of remarkable service rendered to farmers by welders in the rural districts, of machinery suddenly rendered useless in the planting or harvesting season because of one small part, and of how much it meant to be able to get a welder to make the repair on a moment's notice instead of putting up with the delay of sending to the factory for a new part.

Some time ago someone who had learned how Stelliting increases the life of many metal parts which are subject to heavy wear had the idea that this principle could be made to be of real service to farmers if they used it on plow shares, which get about as much wear as anything used on the farm. A few preliminary experiments were made and it was found that a Stellited plow share was a noticeable improvement over a standard steel share. After getting favorable reports from various parts of the country it was decided to conduct a thorough test to establish some basis of comparison between standard steel shares and plow shares which had received an application of Stellite. The test was conducted in the vicinity of Rockford, Illinois.

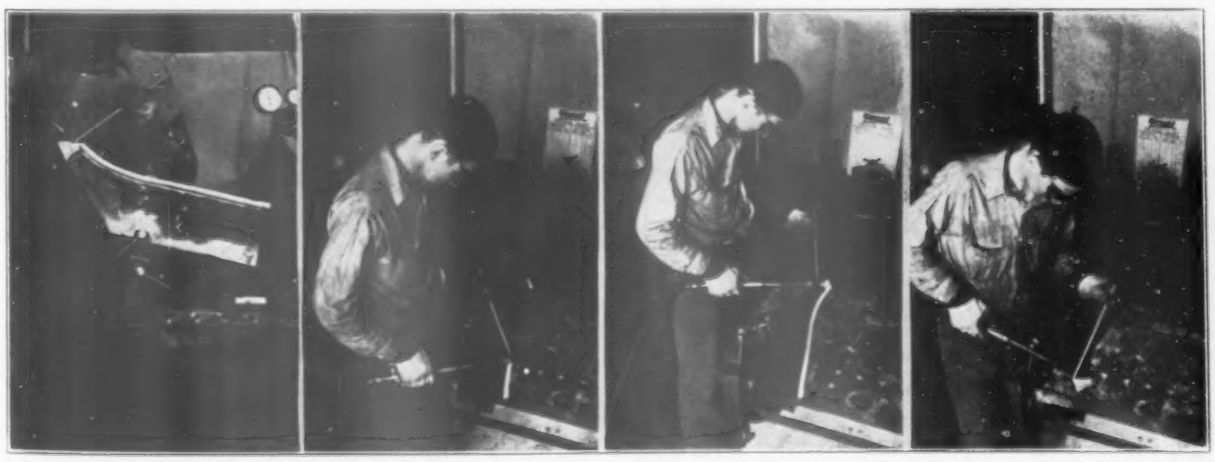
Grinding Operations. First, Grind Off Along Cutting Edge and on Top of Point. Second, Grind Point of Share Flat. Third, Grind Bottom of Point Free From Rust, Grease, Etc. Fourth, Share Prepared For Stellíting.

The soil in this territory is known as "hard plowing land" because the clay base is intermixed with sand and gravel in which is embedded a large quantity of boulders ranging in size from two to twelve inches. This type of soil subjects the shares to a severe test of resistance to abrasive wear and shock or impact. The 219 acres selected as the location of the tests had previous crops of clover, timothy, oats and pasture.

Before starting the tests, consideration was given to costs, method of application in relation to points of wear, the thickness of the coating and the effect of the Stellited surface on a share as to the possibility of retarding the "scour" of the plow under actual working conditions.

Shares were coated with Stellite as follows:

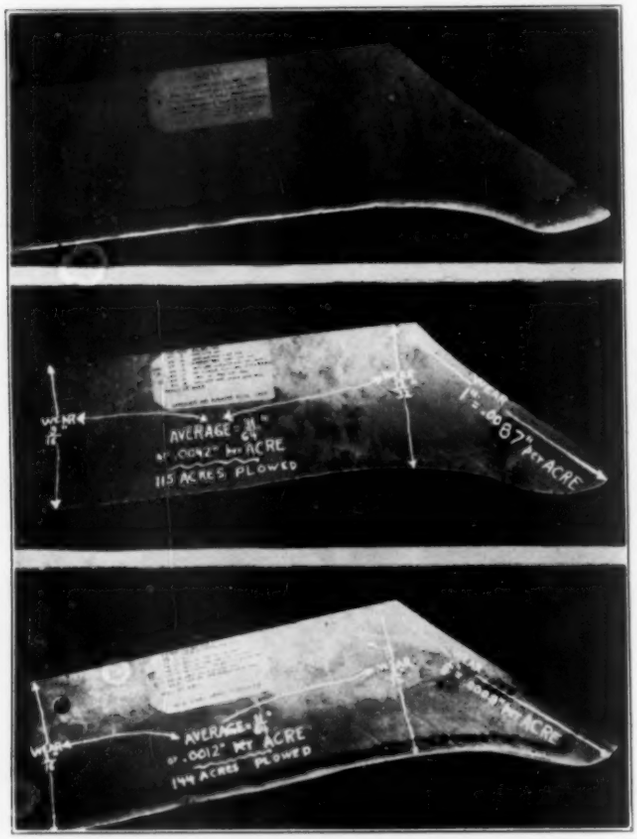
1. The top and bottom of the cutting edge; the top and bottom of the point and the landside.
2. The bottom of the cutting edge only and the top and bottom of the point and landside.
3. The top of the cutting edge only; top and bottom of the point and landside.
4. The top of the cutting edge only; the top and bottom of the point and none on the landside.



Stellíting Operations. First, Apply Layer About ⅛ in. Thick to Edge of Point. Second, Stellite Top ½ in. Wide and About 3/64 in. Thick. Third, Apply on Top of Point 2 in. Back of Edge. Fourth, Stellite Bottom 2 in. Back From Edge, ¼ in. Thick.

The fourth method proved to be the best. These shares were Stellited on the top of the cutting edge with a deposit approximately ½ inch wide and 3/64 inch thick. The top and bottom surfaces of the point were Stellited ⅛ inch thick extending back on the top and bottom 2 inches from the extreme point.

When these shares were put in service they were found to be self-sharpening. The abrasive action of the soil wore away the steel on the bottom side thereby maintaining a sharp cutting edge that cut all roots. The advantage of this self-sharpening feature as expressed by the farmers who own the land



Above—New Share Stellited. Center—Soft-Center Steel Share Worn Back 1 in. After Plowing 115 Acres. Below—Stellited Share Worn ⅛ in. After Plowing 114 Acres.

where the tests were conducted is the fact that "the plow will stay in the ground." These shares were only rough ground to remove high spots on the Stellited surfaces and were not polished but "scoured" immediately.

Shares Stellited by the other three methods did not prove as satisfactory as this type. When heavier thicknesses were applied on the top of the cutting edge there was a tendency to chip at the edge. Chippage also appeared when both the top and bottom of the cutting edges were Stellited. When this light chippage occurred, instead of the share maintaining a sharp edge it had a tendency to round over, would not shear the roots and would finally ride and jump out of the furrow.

Summary of Test

Parts Tested:—Standard steel plow shares Stellited vs. standard steel plow shares from manufacturer.

Machine Used: Tractor drawn three bottom plow.

Soil Plowed: Clay base with sand, gravel and large rocks.

Condition of Soil: Ranged from soaking wet to dusty dry.

Previous Crop: Clover, timothy, oats and pasture.

Location: Byron, Illinois, near Rockford.

Number of Acres Plowed in Test: 219 acres.

Test Continued From: April 16 to May 19, 1928.

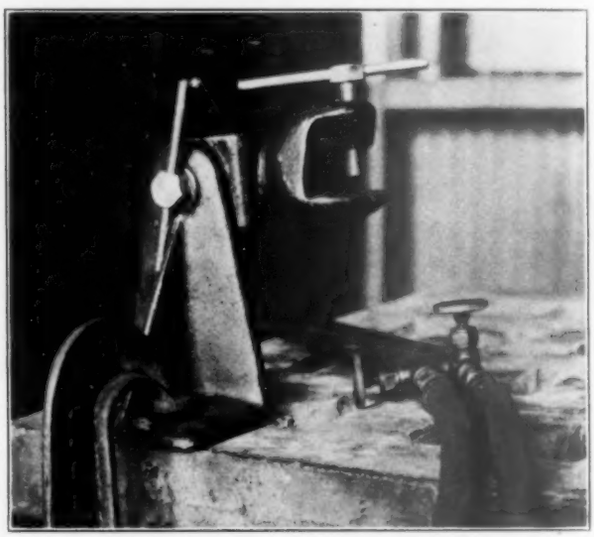
Method of Comparing Wear: Shares when new were actually measured over point and cutting edge. They were then measured each day run and examined for edge condition and sharpness. One standard soft center steel share and two standard soft center steel shares Stellited or one Stellited and two steel shares were used to obtain similar wearing conditions in the same soil.

Results:

	Wear per acre at point	Wear per acre cutting size
Steel shares Stellited	.0011 inches	.0015 inches
Steel shares not Stellited	.0083 inches	.0052 inches
Wear Ratio	7.5 to 1	3.5 to 1
Mean Ratio—entire wear	5.5 to 1	

Soil conditions on this test warrant the statement that these figures can be accepted as a minimum figure for average plowing. This means that the Stellited shares will stay in the ground five and one-half times as long as standard steel shares not Stellited, and remain sharp.

Method of Stelliting: A layer of Stellite ½ inch wide by approximately 3/64 inch thick was flowed on top of the cutting edge of share. The point was Stellited ⅛ inch thick by 2 inches back from point on top and bottom. Oxy-acetylene



Special Fixture For Holding Plowshares.

welding torch with medium size tip was used. Surface ground clean before Stelliting. No flux. Slight excess of acetylene used in flame. No heat treatment. The above method will also apply to shares that have been sharpened in a blacksmith fire.

Time: 15 minutes.

Oxygen: 4 cubic feet.

Acetylene: 6 cubic feet.

Four-tenths of a pound of 5/16-inch diameter Stellite rod used per share.

Those who are not familiar with the method of applying Stellite should note particularly that the process consists of two essential parts: first the grinding operation and second the application of Stellite. It is very important to grind off paint, grease, rust and scale from the top side of the share along the cutting edge and a space 2½ inches wide on the top of the point. Then the point is ground so that it is flat instead of sharp and finally the grinding is applied to the bottom side of the point. The whole story of preparation is to grind to a clean surface and avoid sharp corners.

As to the application of Stellitte, it should be noticed that the base metal is not raised to the welding heat as this will cause the iron to dilute the Stellite, so instead of actually melting the metal of the plow share it is simply brought to a sweating heat, using a neutral flame, and then the Stellite is flowed on using a carbonizing flame, that is a flame having

an excess of acetylene. There should be no necessity for using flux and the Stellite should not be worked into the base metal as in ordinary welding. If the proper flame is used Stellite will flow ahead of the flame like bronze. Take care to float out all particles of oxide or scale and if possible deposit the proper depth of Stellite with one pass of the torch. If it is to be quenched to secure toughness, quench in oil rather than water.

Particular attention should also be given to the fact that tests have shown that the best system to use is the application of the Stellite to the top of the cutting edge and the top and bottom of the point. As the illustrations show, a layer is first applied to the edge of the point about ⅛ inch thick, then starting at the wing and working towards the point to the top, which receives an application about 3/64-inch thick and ½-inch wide, then a ⅛-inch layer is applied to the top of the point about 2 inches back from the edge and another ⅛-inch layer on the bottom of the point about 2 inches back from the edge. A special fixture has been designed, as shown in one of the illustrations, to hold the plow share firmly in position for these different operations.

Stelliting of chilled plow points is not recommended because of the small initial cost of these points and their tendency to work easily when coming in contact with stones and boulders.

Much interest has been shown in this process by welders located in farming districts. It not only gives them something new in the way of service to sell to the farmer but it also gives them one more opportunity to make an interesting demonstration of the value of their service.

ARC WELDED STEEL CONSTRUCTION USED IN FLORIDA PACKING HOUSES

In central Florida there have been erected recently fifteen buildings of arc welded steel construction. Most of these are citrus packing houses, scattered throughout the fruit growing districts. The frames of these structures are all of the clear span welded steel arch type, designed and erected by The

Fig. 1. One of the Fifteen Florida Buildings of Welded Steel Arch Construction.

Arch Engineering and Construction Company, R. L. Graveley, owner, Orlando, Florida.

The largest of these buildings, in fact it is the largest citrus packing house in the world, is owned by the Dr. P. Phillips Co. The building is 117 feet wide by 202 feet long, and due to the welded steel arch design there are no supporting columns in the interior of the structure which contains 200 tons of structural steel.

This building was under process of construction when the two hurricanes spread disaster in Florida in August and September of last year. In the first hurricane the wind blew down the partially completed rear masonry wall, went through the building and blew out the front masonry wall. The arc welded steel super-structure remained intact withstanding the terrific strains imposed upon it by the force of the hurricane. Again in the second hurricane, which was more severe than the first, the strength and rigidity of the arc welded construction was tested severely but the steel framework remained in perfect alignment. Several other buildings of the same design and construction, completed before the hurricanes, survived though adjacent buildings of other types of steel construction were badly twisted out of shape. With the possible exception of a severe earthquake no greater test of the strength and rigidity of arc welded steel construction could be given than was imposed by the Florida hurricanes.

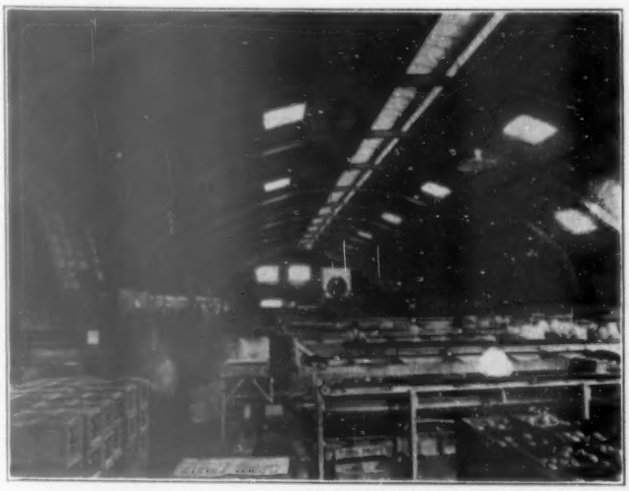


Fig. 2. Showing the Clear Ceiling and Simplicity of Design.

Two buildings used for fruit packing houses have been built for the Seaboard Airline Railway, one 80 feet wide by 225 feet long, at Winter Garden, Florida, and the other at Leesburg, Florida. An exterior view of the latter building which is leased to the A. S. Herlong Company is shown in Figure 1. This particular building is 74 feet wide by 217 feet long, the arches spanning the entire width of the structure as can be seen in the interior view, Figure 2.

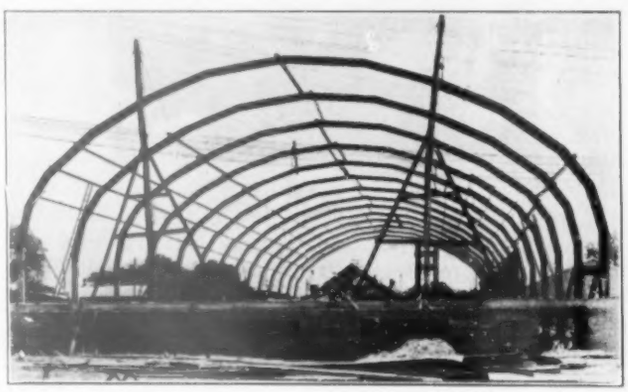


Fig. 3. A Partially Completed Superstructure.

The steel arches are made up of structural channels cut to form an arch when butted end to end. They are then fabricated literally into a one piece steel arch by the electric arc welding process. The entire fabrication of the arches is completed on the ground, then the arches are raised into position and the entire structure thus formed tied in by welding channel purlins to the arches. A view of the partially completed framework is shown in Figure 3. The framework of the monitor, shown in Figure 2, is composed of angles and channels fabricated by arc welding. The steel sash frames are also arc welded in place, in fact, no rivets, bolts, or screws are used in the entire fabrication and erection of these steel arch buildings.

All the fabricating work on these buildings is done in the field, all connections being made by the electric arc welding process. Portable gas engine driven "Stable-Arc" welders manufactured by The Lincoln Electric Company, Cleveland, Ohio, are used to supply the welding current.

The simplicity of the novel design due to the elimination of all trusses and other forms of roof bracing is an economic factor which should favor this particular type of arc welded construction for future buildings. In the last year three large all steel fireproof hangars for aeroplanes were erected at the municipal airport for the City of Houston, Texas. These hangars were also of welded steel arch construction.

NEW LINCOLN APPOINTMENTS

Mr. J. C. Lincoln, formerly President of The Lincoln Electric Company, Cleveland, has been elevated to the position of Chairman of the Board of Directors.

Mr. J. F. Lincoln, formerly Vice President, has been promoted to the Presidency.

Since 1912 when he became general manager of the company of which he now is President, Mr. J. F. Lincoln has been

Mr. J. F. Lincoln.

an outstanding figure in the electrical industry. He was among the first to envision the enormous potentialities of electric arc welding as a manufacturing tool as contrasted with a process for salvage and repair.

So certain was Mr. Lincoln, that arc welded steel construction would supersede other methods of manufacturing machine parts that he insisted on redesigning the complete line of motors and welders manufactured by the Company, to utilize this process. This was at a time when many manufacturers were still speculating on the strength and dependability of welds made by the arc process.

Mr. Lincoln's promotion is a just reward for his perseverance and determination and comes at a time when all industry is turning to the development which he pioneered.

Mr. J. C. Lincoln's new duties will afford him additional time to devote to electrical research and experimental development work which have been his major interest for the past several years.

WHY MAIL IS LOST

The moving season is again with us. More than half a million changes of address were filed with the Chicago Post Office during the past year, according to Postmaster Arthur C. Lueder, but there were many thousands who moved and did not notify the post office, with the result that many pieces of first-class mail and parcel post remained undelivered and great quantities of circular matter and newspapers were returned or destroyed.

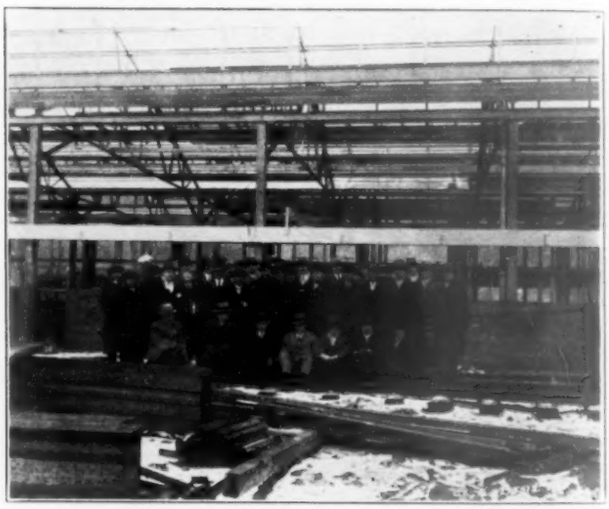
If you move, notify the post office, GIVING THE OLD AND NEW ADDRESSES. Blanks for this purpose may be obtained from the carrier, or any ordinary post card or letter may be used. Roomers should have mail addressed in care of the person whose name appears upon the mail box.

Subscribers should immediately notify the publisher of a change of address so that you may continue to receive your copy without interruption.

PITTSBURGH DISTRICT AMERICAN WELDING SOCIETY HOLDS MEETING

The Pittsburgh district of the American Welding Society held its annual structural steel meeting on January 30 at East Pittsburgh, as guests of the Westinghouse Electric and Manufacturing Company.

The meeting opened with an inspection of the new arc welded factory buildings of the Westinghouse Company at Trafford City, which are now nearing completion. These four structures involve approximately a thousand tons of steel.



American Welding Society, Pittsburgh Section, Inspection Group.

Welding of steel structures has progressed to the point where a considerable tonnage was erected by the noiseless method in 1928. These four structures in addition to their size represent further distinct advances in that the variety of construction calls for practically every type of joint common to structural steel practice. Practically all fabrication was done on the ground and the steel erector become in reality the fabricator as well. The Jones & Laughlin Steel Corporation has the complete contract for the steel and also for the erection. No rivets, and only a negligible number of bolts are to be used in the four buildings.

Following the inspection of these new buildings the society assembled in the Westinghouse Auditorium in East Pittsburgh. Mr. E. C. Brown of E. C. Brown, Engineers, who had charge of the detail drawings of the Trafford job for the Jones & Laughlin Steel Company delivered a paper on "The Detailing of Welded Steel Buildings." Mr. J. F. Minnotte, of Minnotte Bros., who are erecting the Trafford buildings related the new situations and conditions encountered in such work by erectors.

After dinner Mr. G. F. Emery, Chief Building Inspector of the city of Detroit presented a general paper on structural welding from the standpoint of building departments.

About fifty members were present.

LUMBER AND WOOD PRODUCTS*

It is our belief that fully ninety-five per cent of this industry in the states of Oregon, Washington and Idaho utilize the oxy-acetylene and electric welding process to the greatest advantage. The average lumber concern realizes that it would be almost impossible to get along without the use of oxy-acetylene welding and cutting or electric welding equipment. Very rarely does one find a logging camp in this territory without such equipment, and the majority of mills of any consequence have welding and cutting apparatus also. The average logging company or lumber mill is also using an acetylene generator.

From a practical standpoint, the oxy-acetylene equipment is used for almost every imaginable reclamation purpose, particularly in the logging camps. As there are usually a great many men working at these camps and a shut-down would cost considerable money, the process is liable to be called upon almost any time of the day or night. Following are some of the applications in the logging industry:

On logging locomotives: Building up worn pistons, valve gears, shoes, wedges, piston rods, valve stems, throttle stems, and throttles with manganese bronze; welding locomotive frames, cylinders, brake and spring rigging; also building up spring and brake rigging where worn; fire box welding, flue sheet and general welding in all stayed areas on both locomotive and donkey boilers.

On donkey and logging equipment: Welding broken drums, brackets, frames, fair lead blocks, high lead blocks, carriage blocks, fall blocks, and haul back blocks; building up drums cut by cables with manganese bronze; bronze welding manganese sheaves; building up slid flat spots on cast iron car wheels with manganese bronze; safe-ending boiler tubes for donkey engines, and reclaiming all other equipment which wears or breaks.

In the lumber mills the applications are also varied. However, the welding process is not used so extensively in the mills as in the logging camps, as the mill machinery does not get the hard usage the logging machinery gets. The process is used in mills for welding of broken nigger heads and push arms, bronze welding broken kicker cylinders and other steam cylinders, welding cracks and broken-off teeth on band and circular saws, building up pistons with manganese bronze, safe-ending boiler tubes, building up worn links and bull chains, welding cracks and broken teeth on bull gears and other gears, welding broken spokes and cracks in pulleys, filling up worn-out holes in conveyor links with bronze, welding broken cast iron bearing bases, building up worn bronze bearings, welding of broken machine frames, and hundreds of other applications incidental to the working of mills; in fact, the applications are so numerous that it is impracticable to mention all.

There is no other single piece of equipment used in a logging camp or lumber mill which is so important as welding and cutting equipment, as it saves them money. However, there is another feature which is just as important: The saving in time. An argument that is used to sell generators to logging camps and mills is that they carry insurance on their plants, automobiles, houses, etc., and it is just as important that they have a welding and cutting outfit and generator to insure against break-downs in their operation; for, when there are several hundred men working in a logging camp, they cannot afford to close down, and can practically be assured of continuous operation by having a welding and cutting outfit and operator properly instructed in the work to take care of the different problems which come up, and thus know that, regardless of the kind of break-down, it can be repaired and the plant put in operation again in a very short time.

*Reprinted from the Report of the Oxy-Acetylene Committee of the International Acetylene Association, 1928.

ARC WELDING TEST

Westinghouse engineers recently tested the strength of arc-welded structures by subjecting an arc welded bedplate to a 50-ton shock test. The bedplate, weighing 4,000 lbs. has an overall dimension of approximately 50x100 inches. The structure consists mainly of 162 pound H beams and various pads measuring about 2 inches in thickness.

The welds are all ½ inch fillet welds, about 6 inches in length and the maximum distance between the welds is 10 inches.

Welded Bedplate After 50-ton Shock Test.

In the test a 50 ton weight was allowed to drop on the bedplate from a height of 8 feet. Despite the fact that the bedplate was considerably distorted, only one weld failed under the intense shock. This one weld which failed was at the end of the two inch plate on which the weight fell.

OIL TANK SHIPS WELDED IN GERMANY

By Carl Commentz

There were completed some time ago at the yards of the Deutsche Werke, in Kiel, two oil tank barges, which were arc welded almost entirely. As the ships are intended for naval purposes, their construction was not supervised by any classification society and the rules of these societies could be neglected, so that the builders had a free hand in designing the ships in accordance with the construction properties of electric welding. The oil tank barges have, as reported in a late issue of "Werft Reederei Hafen" a dead-weight capacity of 600 tons each at the main dimensions of 43.8, 2x4,25 meters and at a draught of 4,25 meters. The plates of the decks and of the shell are not laid in the longitudinal direction of the ship but atwarthships. There are thus longitudinal seams only at the keel and at the edges between the shell and the deck. These longitudinal seams were riveted, as well as the connection of the shell with the rudder stem. All other constructional parts are welded electrically without any exception. The stiffening of all plates, that is, frames, deck beams and bulkheads stiffeners was accomplished by welding bulb bars with their edge against the plates, so that no flanges, as for riveting, were necessary. The regular shell thickness of such craft, according to the rules of the classification socie-

ties, is 8 millimeters, but in riveted tank ships all plates are weakened by the rivets in the oiltight bulkhead seams by about one third, so that their strength is about that of 5½ millimeters only. In the shell of a welded ship there is no such reduction of strength. Therefore the shell thickness of the welded tank barges has been reduced to 7 millimeters, this being decidely superior to riveted ships with a shell of 8 millimeters. When designing the ships, special care was taken to avoid warping of the plates and other parts, when they were being welded. It was possible to arrange all weld seams so that no warping was experienced. The ships have three oil tanks amidship accommodations for the crew in the forecastle and an engine room for a 70 horsepower Diesel engine at the stern. The tanks are separated from the ends by cofferdams. It was, of course, difficult to procure enough well trained welders for the job. Therefore the trained men were used for welding the middle part of the ships, where oiltightness is of importance; at the ends less experienced men were set to work. It was found that it is possible thus to train a good number of skilled men in a short time. The tests, to which all parts of the vessels were submitted, proved that all welded seams were entirely tight; only the riveted seams showed some trifling leackage and had to be recaulked.

The enormous importance of welding ships is the saving of weight that arises from the fact, that all overlaps, all flanges for stiffeners, and similar parts, which do not contribute themselves to strength, are dispensed with entirely. The steel weight of one of these welded tank barges amounts to 145 tons against 211 tons of a riveted vessel, so that the saving of weight amounts to 32 percent. The best economy was attained at the stiffenings so that the weight of the bulkheads, the strengthening profiles of which add most to the weight, was about 47% lower. Including all equipment parts, the saving embraced 70 tons. As to the costs of welded ships, a calculation showed that the costs for a welded ship of certain dimensions are about as high as for the riveted ship, so that one ton deadweight of a welded vessel is considerably cheaper, as the deadweight capacity of welded ships is by about 13% larger than that of riveted ones. It is of high importance for the development and further introduction of electrical welding in shipbuilding that the German Navy takes a large interest in this industry and is applying welding on a larger scale in the naval construction. The application of electrical welding in the naval construction will provide a good opportunity for the classification companies to gather experience with the method, which will later on form the basis for an application of electrical arc welding in merchant shipbuilding under the jurisdiction of the classification societies.

ARTIFICIAL ICE MAKING REQUIRES LEAKPROOF PIPING AND MACHINERY

One of the prime requisites for artificial ice manufacturing is an efficient, gas-tight and moisture-proof piping system. The manufacture of artificial ice by the ammonia and brine system is by no means a novelty. It has been common practice for a great many years, but the early adoption of the principles involved were more or less embarrassed by temporary shut downs due to leaking pipe connections or faulty machinery.

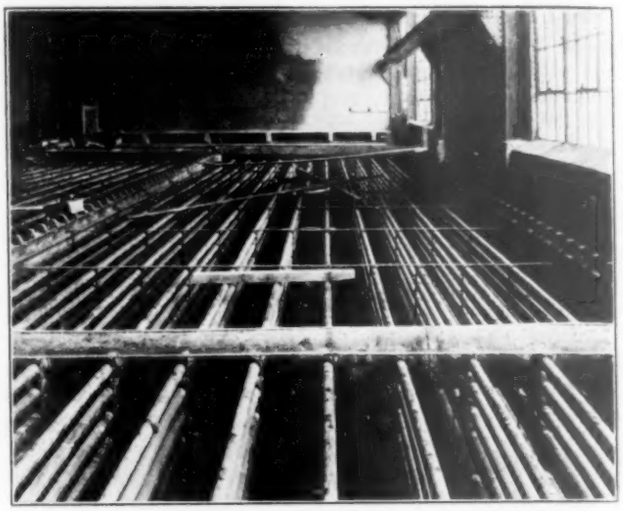
This was especially true as regards the adoption of the principle to artificial ice skating rinks. Personal observation in both Canada and United States during the early days of artificial ice rinks recall to the writer's minds that these plants were continually getting out of order and the trouble, nine times out of ten, was traced to leaky pipe connections under the ice surfaces.

Today with modern arenas in most of our large cities, such occurrences are neglible. Modern ice making machinery and the application of the oxy-acetylene process to most of the pipe requirements has produced a truly gas-tight and moisture-proof system.

Countless artificial ice plants, operated solely for consumption purposes, supply our cities and towns with pure ice. Railroads draw from this source for car refrigeration. Other types of artificial ice plants operate as cold storage units. One and all they have adopted the welded joint as the most practical and efficient for their purposes.

The average refrigeration plant, with its tanks, coils, tubes, and piping, contains a fertile field for oxy-acetylene welding. Applications for the process are almost innumerable.

Headers and receivers which formerly were made of cast iron are now fabricated of welded boiler plate. The latter construction has proved both tighter and safer. Tanks and



Scene in Ice Plant Showing Extent of Welded Piping.

special piping with their necessary specials are among those things most easily fabricated and repaired by means of the oxy-acetylene process. Piping systems carrying two, and often three fluids, must be kept separated from each other. A tank, a coil, or a straight pipe may do the separating provided that piece of apparatus has tight joints.

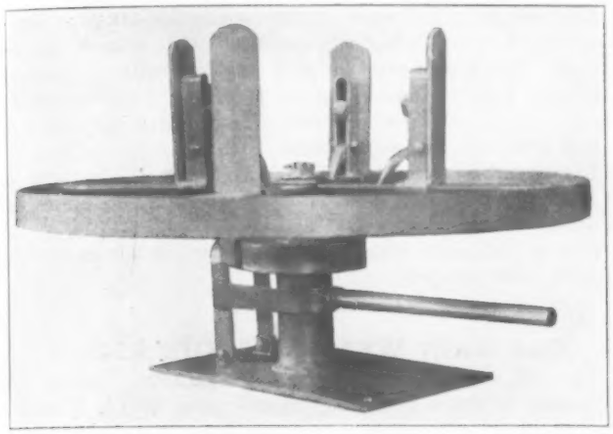
A few years ago an ice making plant was set up in the middle west to take care of a prominent railroad's refrigeration car needs. The ammonia system consisted of over 35,000 feet of pipe. There were some 9,000 welds in the entire plant. Before the machinery was put in operation the pipe system was tested at 160 lb. pressure for twelve hours. Then a vacuum was placed on the system for twelve hours before the coils were charged with ammonia. Only a very small number of pin hole leaks developed during these tests. These were quickly and economically repaired by welding. The plant has operated continuously ever since, turning out 130 tons of ice each twenty-four hours. It is a model of efficiency, and a lasting testimonial to the welded joint where tightness and strength are prerequisite qualities.

TWO NEW ALL WELDED PRODUCTS

The Pittsburgh Producers Supply Company has developed two new all welded products and added them to the list of other welded products being produced by them. One of these is a new form of wire reel, or swift, especially adapted for use in connection with cable or wire rope stranding machines. The reel has overall dimensions of 36 in. diameter by about 24 inches high. It has a load capacity of 300 lbs. and a rated speed of 800 R. P. M. The jaws are adjustable to take coils of from 12 to 30 inches inside diameter.

The whole reel is made up of steel sections cut to form and welded together, making an assembly considerably lighter and simpler than is usually the case. The rim is formed of a 2 by ¼ inch section rolled to shape and butt welded. The

hub consists of a plate 4 inches in diameter and ½ inch gauge, to the circumference of which is welded a collar of seamless tubing 2 inches high. This collar provides an abutment for the T sections making up the reel spider. These sections, made of ¼ inch gauge stock are butt welded to the rim and hub collar, and serve to support the reel dogs. The dogs are made of U sections formed at the bottom to fit over the upper part of the T section of the spider. They are bolted



New Welded Wire Reel.

to the face plate, and the whole is adjustable by means of a dog which fits in holes drilled in the T section. The face plates are removable.

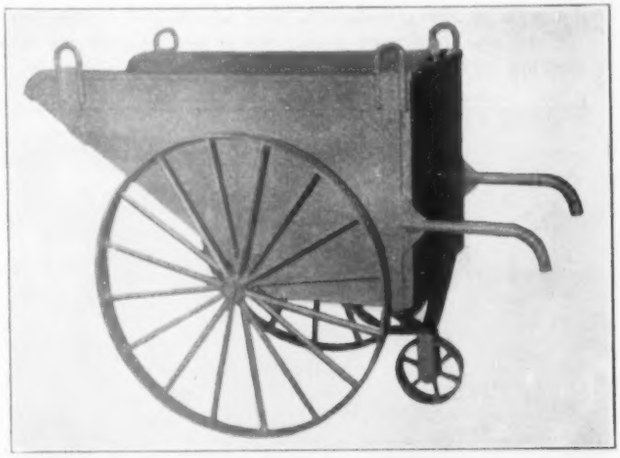
The standard is made from a piece of extra heavy 3 inch seamless tubing, welded to a heavy 20x20 inch flat plate, equipped with bolt holes at the corners for mounting. The center shaft is made from 1½ inch shaft steel, and is mounted in two Timken Bearings, which support the whole load of the reel and spider, as well as serving as guide bearings for the shaft. A very simple form of brake rigging has been developed, consisting of a U section, bolted to two studs which are welded to the base plate. The wooden brake shoe is bolted to the upper portion of the U. The brake drum consists of a plate spider welded to the shaft, to which is welded a rolled section, to form the drum. The operating mechanism consists of a piece of seamless tubing welded to a U section, the ends of which are lap welded to the U carrying the brake shoe. The whole makes a very light, compact, and mechanically simple arrangement, capable of operating at the necessary high speeds with a minimum of attention and maintenance.

The other product is a newly developed shop truck.

It has been primarily designed for use as a nail buggy for use between the various departments of nail mills. It is also suitable for work in various sorts of industrial plants where heavy, loose material is to be moved in bulk, such as machine tool turnings, small castings, or small metal parts for example. The truck has a rated capacity of 1500 to 2000 lbs., with a tare weight of 150 lbs. The dimensions of the body are 36 inches long by 24 inches wide, by 24 deep at the maximum depth. It is mounted on two 30 inch wheels and one 8 inch pilot wheel having a 2 by ¼ inch tread.

One of the unique features of the truck is its construction. Wheels and body are made entirely from steel sections welded together, no rivets being used. The body is made five sections of ⅛ inch gauge plate, stamped to form and lap welded at the corners. The body is reinforced at both ends by 2 by ¼ inch straps bent to form and lap welded in place. Each corner of the body is equipped with a heavy bent rod bail, welded to the reinforcing strap and to the body as well. The bails have been provided so that the trucks can either be lifted by a crane, or hauled in trains. The handles consist of heavy tube sections, flattened at one end, butt welded to the straps and lap welded to the body. They are reinforced by three gusset plates lap and butt welded to both handles and body. The body is strengthened at the rim by a 1 by 1 by ⅛ inch angle section welded all the way around.

All three wheels also consist of welded parts. The treads of the 30 inch wheels are made of 2 by ¼ inch strips, rolled to form and lap welded at the joint. The spokes are made of pipe, butt welded to the tread and hub respectively, and staggered for greater strength. The hubs are made of seamless tubing, and the axle consists of a square bar, lap welded to the body on both sides, and machined at the end. Each wheel is mounted on two Timken Bearings, arranged to with-



New All Welded Shop Truck. Note Neat, Sturdy Appearance.

stand the thrust load occasioned by the passage of the truck over rouge or uneven surfaces. The construction of the pilot wheel is similar to that described, except that the spokes are made of flat sections instead of rods. This wheel is supported on a stub axle, held in a strap frame which is pinned to the body reinforcing strap. Two Timken Bearings have been mounted in the wheel hub, and the turning pin is equipped with a Timken thrust bearing. As a result of a liberal use of tapered roller bearings it has proved possible for one man to handle a truck when fully loaded.

OBITUARY

Dr. H. E. Sturcke

We publish with great sorrow the notice of the death of Dr. H. E. Sturcke, on Wednesday, April 3rd, at his home in Port Orange, Florida. Dr. Sturcke has been an oustanding figure in the Compressed Gas Industry for many years, devoting a great deal of his time and energy to the development of gas cylinder design, construction and testing. His technical works in connection with the problems of cylinders have long been recognized as authoritative, and to him belongs a generous share of the credit for the perfection of the present containers as safe articles of transportation. His father, coming from Switzerland to the United States, was naturalized as an American citizen but left this country to establish his residence in Mexico. It was there that Dr. Sturcke was born. As a boy he was sent to school in Europe and completed his education by studying chemistry in Switzerland and Germany. While a young man Dr. Sturcke taught as an assistant Professor of Chemistry at a cultural school in Hohenhain, near Stuttgart, Germany. Coming to the United States, Dr. Sturcke applied himself in the work of his profession with unusual success, later becoming an official of the Crescent Chemical Manufacturing Company. From this point on in the Doctor's life his interest in the Compressed Gas Industry never waned, and even after his company had passed into other hands his work and research continued. Until the time of his death Dr. Sturcke co-operated with the committees of the Compressed Gas Manufacturers' Association, unselfishly, contributing his invaluable knowledge, energy and assistance to the solution of their problems. In recognition of this devotion the Compressed Gas Manufacturers' Association had elected him an Honorary Member.

AUXILIARY AUTO WHEEL CONSTRUCTED BY WELDING

An auxiliary or safety auto wheel which was recently invented by Mr. Philip H. Bachrach of Oceanside, California, is being constructed through the use of welding by Mr. Ed. Wright of the Oceanside Welding Works. The wheel shown in the picture was made by cutting down a disk wheel, cutting a section out of an ordinary rim, fitting the rim on the disk, and welding the two together. Then a solid rubber tire was put on and the wheel was ready to be installed. As can be seen in the photograph, they are bolted to the inner side of the wheel in such a way so as not to interfere with the steering or the brakes.

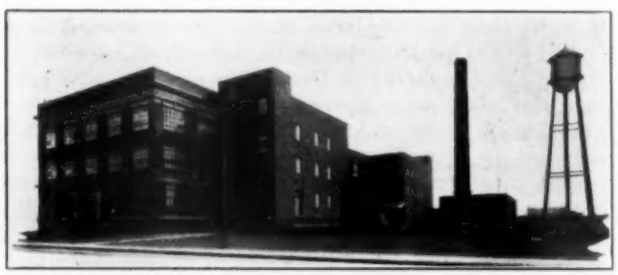
Auxiliary Auto Wheel—Note Position of Two Wheels Installed.

This wheel serves several purposes, the principal one being to act as a safety device in case of a blowout. When a sudden puncture occurs this inner wheel catches the weight of the car and saves it from the dangerous swerve which always accompanies a flat tire. The car can be run on this auxiliary wheel to a good stopping place or to the nearest service station without further injury occurring to the punctured tire.

The manufacturers state that one of the large motor coach companies of the west has accepted this auxiliary wheel as part of the equipment of their busses after having given it a thorough tryout. This invention is another addition to the rapidly growing list of all welded products.

INDIANAPOLIS SALES OFFICE FOR ELKON

P. R. Mallory & Co., Inc., of which Elkin, Inc., and Knapp Electric, Inc., are divisions, announces the purchase of a new all fireproof four-story building in Indianapolis.



New Home of P. R. Mallery & Co., Inc.

Both divisions are large suppliers to the automotive industry and the purchase was, to a large measure, influenced by the desirability of securing a location which would insure better service to this industry.

Elkon, Inc., supplies Electrical Contact Points to all of the large ignition manufacturers. They also supply Elkonite, a welding electrode and die material used largely by the automotive industry.

Knapp Electric, Inc., supplies small motors to the manufacturers of the new forced draft heaters, both hot air and hot water.

The company will start moving its Radio and Toy divisions into the new plant April 1st. These divisions will be entirely set up and in perfect running order before the other divisions are moved.

It is estimated that the entire plant will be in operation by October 1st.

The new plant has about 200,000 square feet of floor space, is entirely fireproof, completely sprinkled and is modern in every respect. The power plant is in a separate building, which is connected with the main plant by a subway. Railway sidings are in. The plant is enclosed with a fence and is surrounded by a well kept lawn with flower beds.

The executive offices of P. R. Mallory & Co., will be continued at 350 Madison Avenue, New York, but the main sales offices will be located in Indianapolis.

A New York sales office will be maintained to take care of the Eastern manufacturers.

GAS MAIN WEATHERS THE STORM

The following account of the punishment a welded line withstood is taken from the January issue of the American Gas Association Monthly.

In the spring of 1927, a 12-inch steel high-pressure transmission gas main was run by the forces of the Delaware Division, Philadelphia Suburban Counties Gas and Electric Co., to connect the Upper Darby holder to the district governor at Pine and Mill Streets, Darby. That main also formed part of a connecting system between the Upper Darby Gas Handling Station and the Chester Gas Plant, which is located on the banks of the Delaware River. The main was run in accordance with the usual practice, using 12 inch—45 degree bevel steel pipe, extra heavy semi-steel valves, without the use of expansion joints, welded for the entire length, and laid at a depth of three feet, six inches.

A severe rain and wind storm spread over the territory on August 17, 1928, and caused considerable damage. Although gas service was not disturbed by the storm, there were numerous washouts and floods which made it difficult to maintain uninterrupted service.

The greatest damage occurred where the continuous downpour of rain caused a sewer pipe to collapse under the pressure of the surface water. The sewer was the only means of draining the water from the section, and on this particular occasion it was not large enough. When the pipe collapsed the released water washed away the earth in which the 12 inch high-pressure gas transmission main had been laid, and left the main exposed in a suspended position, as shown in the accompanying photograph, for a distance of 97 feet.

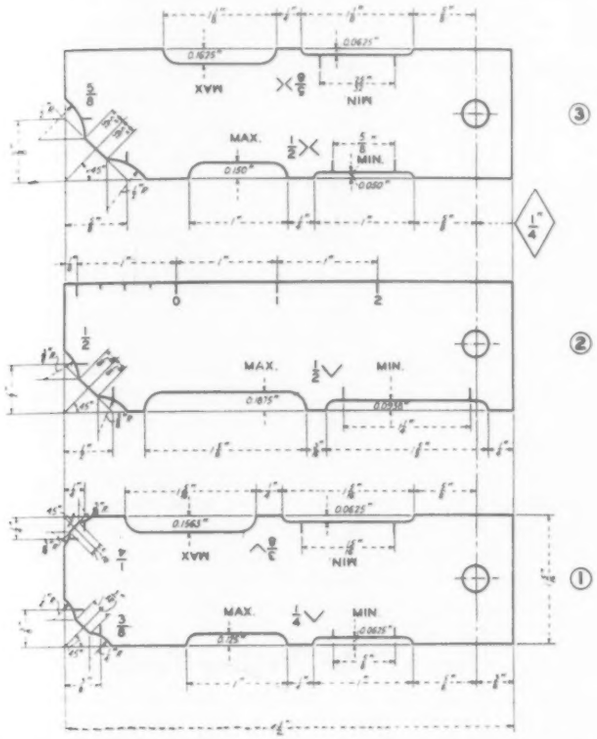
As the section is an undeveloped one, which is impassable for vehicular traffic, and as no difficulties had developed along the line of main, the pipe remained in a "state of suspense" for several weeks before it was discovered.

A first glance at the photograph may lead one to believe that there is a slight sag in the pipe, and that it was near its yielding point when it was discovered. The slight dip to the pipe is not due to any strain in the metal itself, but is attributed to the fact that the main starts up a hill at that point and the bend was placed there when it was laid. An examination failed to reveal any sags in the pipe due to the suspension.

In the suspended portion of the main five welded joints were exposed, and although there was an enormous strain on the welded portions of the main particularly, they all held intact. The Delaware Division believes this to be a good test of welded joints under adverse conditions. It is reasonable to believe that the pipe had to support much more than its own weight in its suspended position.

GAGES FOR MEASURING FILLET WELDS AND REINFORCEMENT ON BUTT WELDS

A useful combination gage for measuring the profile of butt and fillet welds has been developed in connection with the work of the Structural Steel Welding Committee of the American Bureau of Welding. With these gages, a weld can be tested to determine whether it comes within certain tolerances for



Drawings Showing Graduations of Gages for Measuring Butt and Fillet Welds.

a definite size of weld. While this is a quantitative test only, it is a positive method of checking the size of fillet or amount of reinforcement of a butt weld against the specifications. The profile of the weld is as important as the quantity of metal deposited, and these gages also indicate whether the weld has sufficient cross-sectional area. In the case of butt welds, the width as well as the depth of the reinforcement is shown by the gage.

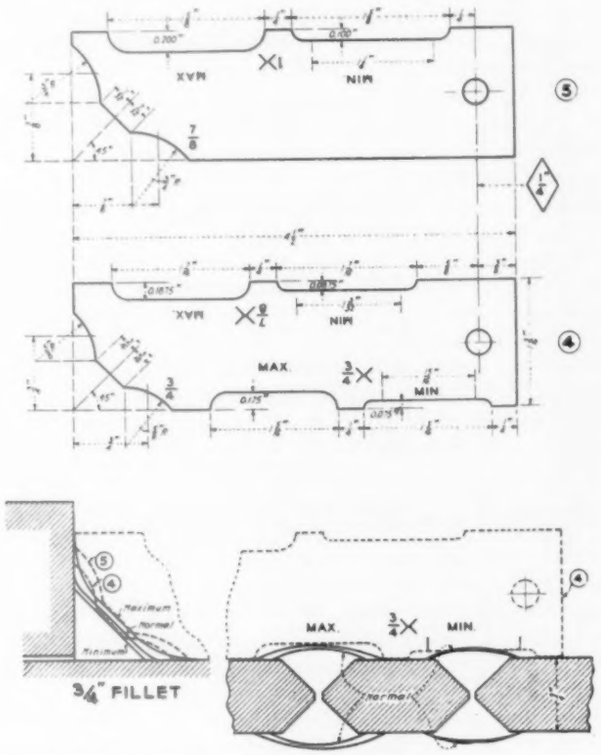
THE LITTLE IFS AND WHYS

By Sven W. Fransson

Odd, what a fellow can find in this world, even if he is not looking for things waiting to be found, but takes everything for granted without ifs or whys. The if, in this case, comes in on a small size copper tubing 1-16" I. D. with 1-32" walls making this tube ⅛" O. D. which had both ends brazed to a 3-16" I .D. copper tube in 6 in. lengths. This larger part was used for the purpose of fitting hexagon nuts to hold the tube to a valve, the tube being flared to make a tight joint. This construction is being used by a concern in their electric refrigerators for the high pressure gas line. In brazing this tubing, the operator at times neglected to run the brass all around the tube sufficiently to stand the vibration of the machine, and often one side would show an outline of the larger tube instead of being all filled in with the added metal. This would sometimes cause a small leak that would not be enough for an odor in the room, but in time it would reduce the content of gas so the freezing capacity was lowered enough to be noticeable in two or three months.

I have spent much time installing and servicing electric refrigerators for domestic use, I will pass on some of my experience so that welders and brazers can see how a little thing will mean a big thing. The little thing I have in mind is one end of the joint copper tube I have been telling about, and the big thing is the trouble to the owner, cost to the dealer and loss of reputation to the particular make of refrigerator.

Installation was made on May 15, 1927, the cost being $15.00. The first service call was on August 28, 1927. The



Lower Left Shows Use of Gage on Fillet Welds. Lower Right Shows Use of Gage on Butt Welds.

upper ice tray was not freezing, showing lack of gas (sulphur dioxide in the freezing unit). I examined tubing and joints for leaks, but found none, added one pound of S02, checked up on the machine and found everything was O. K. The cost of gas, time and travel was $4.50.

Second service call was on March 3, 1928. There was lack of S02, but there was no leak. System charged with one and one-half pounds of S02, time and travel amounted to $4.75.

Third service call was on May 6 of the same year. The freezing cabinet showed lack of S02 and as there had to be an end to this one way or another, preparation was made to stay all day, so we had gas cylinders, copper, gas lines, ammonia for testing, and lunch for our physical need.

After noting the amount of gas lacking and testing all joints and valves, we found no cause for this condition. We sat down to watch and wait. Finally, we ate lunch and then examined the unit again and, behold, there was a speck as a prick of a pin point at the joint of the two tubes. Applying concentrated ammonia, it did not show any signs of gas, but it disappeared when touching it and showed signs of returning again. After taking the pressure and vacuum readings and staying on the job for about ten hours, we pulled for home. Total charges for three trips, $28.25.

This cost was born by the dealer who guaranteed one year's free service, besides the loss of good will. Taking the faulty gas line and after testing it, we found it would hold vacuum for a while, and also that it would hold 100 lbs. pressure and cause a bubble of soap water the size of a pea in about one hour's time. The magnifying glass showed a small pinhole in the seam between the two tubes which could have been closed by the brazer who did the work with a

movement of the torch in the time of less than five seconds.

A little means a lot sometimes.

Here is another little tip from my welding experience.

I had done several thousand small welding jobs, parts of machinery, small gears, irregular shapes that I could only set by the broken surfaces and weld, using clamps, screws, plates. Even if bolted together, they would warp or fall apart, get out of true, and cause trouble in many ways, and most of these jobs, after they once lost their shape, were lost to usefulness regardless of how good the weld was.

As I was preparing a small gear to be welded, a thought came through my mind that made me stop and throw away clamps, screws, wedges, and all its paraphernalia; and instead I went and got about 50 lbs. of moulding sand right off the foundry man's shovel. This I placed in a box, patted it down fairly hard, and then placed the parts of the broken gear together, pushed it down into the sand until it rested even and solid: and with a six inch scale, I dug out around the breaks on the gear, and repaired in a few minutes what otherwise would have been a nuisance to weld. After that, a sand table is a part of my welding corner that is indispensable. Any sand will do. A little clay or flour mixed with it is good, and just wet it enough so it stays put. It is not necessary to let the sand dry. It beats plaster, asbestos, or anything I ever tried.

WELDED PRODUCTS AT FOUNDRY SHOW

This month the American Foundrymen's Association held its annual convention and exhibit at the Hotel Stevens, Chicago, Illinois. The spaces in the exhibition hall were well filled with equipment and materials used in foundry processes. Every year there is a noticeable increase in the number of different pieces of equipment which are constructed by welding and in some cases there are found pieces of equipment which are all welded. In this year's exhibit oxy-acetylene welding and cutting equipment and supplies were displayed at the booths of the Air Reduction Sales Company and the Linde Air Products Company.

NEW GROUND CLAMP FOR ARC WELDERS

One of the newest devices offered to arc welders is a special type of ground clamp or wedge sold by John P. Engstrom, 625 N. Main St., Los Angeles, California. This clamp comprises a steel casting in one end of which a cable for the ground connection is inserted and held rigidly. The other end has three long projecting clamps so arranged that they will grip a plate or other member with a strong wedging action. The casting provides a heavy rib projecting so that it can be hammered in place or knocked loose. It can be used on either flat or rolled material. It makes possible getting a solid ground connection quickly, which prevents the ground and electrode from getting hot. A good mechanical connection for the cable saves wear and tear on the cable. These wedges are made in various sizes to take care of stock of different thicknesses.

STOODY AND VICTOR WILL CO-OPERATE

We have been advised that Victor Welding Equipment Co., of San Francisco, California, have become the exclusive distributors of Stoody products in Northern California, and that the Stoody Company of Whittier, California, have been appointed exclusive distributors of Victor Welding and Cutting Apparatus in Southern California.

It is the intention of these two companies, who are non-competitive, to work their respective sales and advertising programs in very close co-operation and will establish, wherever possible, joint jobbers. This program should prove to be of particular interest to the users of hard-surfacing materials and welding apparatus, and to existing and prospective jobbers for the two companies.

The sales of both the Stoody Company and the Victor Company have tripled for the first quarter of the year 1929, as compared with the same period of 1928, and this remarkable progress is a splendid indication of the very high regard in which these two respective companies and their products are held in the eyes of the welding trade.

BOOKLET ON RAIL WELDING AND BONDING

A complete description of all of the apparatus required for the arc welding and bonding of rails is given in Circular No. 17, issued by The Electric Railway Improvement Co., Cleveland, Ohio. This equipment includes rheostat, trolley pole, welding furnace, portable grinder, larry to carry the apparatus, welding handshields, helmets, electrode holders and other accessories, all of which are sold by the above company under the trade name of "Erico." This booklet also describes several types of arc welded and brazed rail bonds.

BOOKLET ON A.C. WELDING

A 44-page illustrated booklet entitled, "Electric Arc Welding With Alternating Current," has been prepared by the Martindale Electric Co., 1260 W. 4th St., Cleveland, who are distributors for the Seneca arc welder. Besides giving the advantages of the alternating current welding process, and a description of the other processes in general use, the booklet contains some useful working data, and a section on the installation and operation of an arc welder, explaining in detail its application to various types of work.

News of the Welding Trade

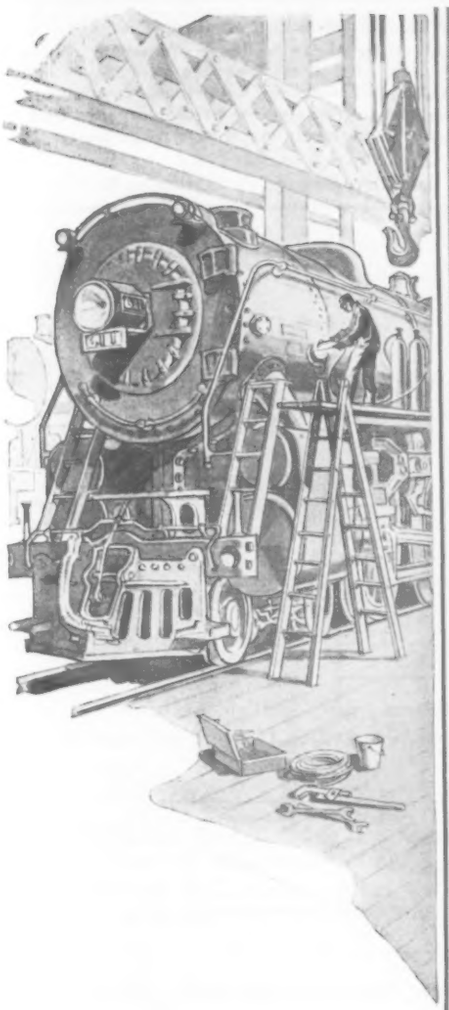
James A. Muir has been appointed assistant to the president of the Taylor-Winfield Corporation, Warren, Ohio, manufacturers of Taylor-Winfield electric welders. Mr. Muir, who has been connected with the welding machine industry for more than twenty-five years, was one of the originators of the old Toledo Electric Welding Co., and was until recently sales engineer for the latter concern. Manufacturing facilities have been appreciably enlarged, and the personnel of the engineering department has been increased.

At the regular monthly meeting of the Victorian Institute of Welding Engineers, held in the main lecture room of the Working Men's College, Melbourne, Australia, Mr. E. J. Raymond read a lecture entitled "Welding Experiences Abroad."

It is reported that the American Electric Fusion Corporation of Chicago will soon start the construction of a large addition to their present manufacturing plant at 2610 Diversey Ave. This firm manufactures spot and seam welding machines.

Charles F. Palmer has been eleced president of the C. H. Hollup Corporation, Chicago, manufacturers of welding wire and equipment. Mr. Palmer has been identified with the Pittsburgh Steel Products Company in the Strauss Building, Chicago, for a great many years and will continue to maintain an office at that address.

Mr. E. P. Boyer has been elected vice-president of the Alexander Milburn Company, Baltimore, Maryland. Mr. Boyer has been associated with the company since 1919 as Philadelphia district manager. Since that time he has established sales companies in Philadelphia, New York and Chicago. His appointment also is announced as vice-president of the Milburn Sales Corporation and the Milburn Paint Spray Corporation who are distributors of all of the products of the Alexander Milburn Company.



WELDING COSTS

reduced 45% to 78% through the use of

TOBIN BRONZE

WELDING costs have been reduced 45% to 78% through the use of Tobin Bronze Welding Rods in the repair shops of one of America's largest railroads, where, almost without exception, Tobin Bronze welds have proven stronger and more dependable than repairs made with other materials.

These results are obtained because Tobin Bronze flows freely at 1650° F., and very little pre-heating of the part to be welded is required, which means less time and less gas. And when properly made, Tobin Bronze welds in cast-iron are stronger than the casting itself.

Tobin Bronze is manufactured solely by The American Brass Company and the name "Tobin Bronze" is stamped in every rod. It is sold by distributors of welding supplies and equipment everywhere. A sample rod for testing purposes will be sent upon request.

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ANACONDA
WELDING RODS

ANACONDA
from mine to consumer

There is a suitable Anaconda Filler Rod for every welding purpose. The principal Anaconda Welding Rods, with their melting points, are listed below:

for oxy-acetylene welding

Tobin Bronze	1625°F
Manganese Bronze	1598°F
Brazing Metal	1634°F
Electrolytic Copper	1981°F
A. B. Naval	1625°F
Everdur	1866°F
Silicon Copper	1981°F

for arc welding

Phosphor Bronze	1922°F
Everdur	1866°F

"STANDARD"
Welding Wire
GAS AND ELECTRIC

for sound permanent welds : : lower costs
Our costs are considerably under those of large industrial centers; ours is a one-profit wire sold direct to user from our own mills exclusively devoted to making of welding wire from raw material to finished product—hence our extremely low prices for wire that is definitely superior. Adopted exclusively by many large users.
Prices on request.
A grade for each type of work—send for samples. Standard Steel & Wire Co., Greensburg, Pa. (Mills at Bolivar, Pa.)

The Western Welding & Equipment Company of Chicago, Ill., which has been located for a number of years at 1040 West Lake Street, will move this month to new and larger quarters at 1434 West Lake Street. Mr. J. M. Jardine, proprietor of the company, states that the new location will provide not only much larger working space but greatly improved facilities for handling the work.

A joint meeting of the Boston chapters of the American Society for Steel Treating and the American Welding Society was held Friday, April 5th. Mr. J. R. Dawson of the Union Carbide and Carbon Research Laboratories read a paper on the subject of "Fusion Welding."

The Department of Vocational Education of the Oakland Public Schools, Oakland, Calif., has recently issued a bulletin entitled "The Fusion Welder in Oakland." This is a 26-page booklet, which gives a well illustrated discourse on the nature of fusion welding and the opportunities which exist for the welder. It also gives details regarding the training in welding available at the Oakland Central High School. This excellent booklet is prepared by C. A. Britton and W. C. Matthews.

Report has been received that a large addition has been made to the plant of the Acme Welder and Boiler Works, located at 3530 W. 73rd Street, Cleveland, Ohio.

The Harry G. Masten Company, 105 W. Monroe Street, Chicago, has been appointed Chicago distributors for Una Welding machines and welding wire and announces that it will carry warehouse stocks of all Una products in Chicago for prompt delivery.

Notice has been received that the headquarters of the American Institute of Steel Construction will be located at 200 Madison Avenue, New York City after April first.

A. A. Weigel, formerly of the Edwin S. Woods Company, has been appointed sales manager of the C. H. Hollup Corporation, manufacturers of welding wire and equipment, with offices at 3333 W. 48th Place, Chicago.

Classified Ads

Help Wanted—75c per line, minimum 4 line

Jobs Wanted—4 lines free.

Other Ads—$1.00 per line, minimum 4 lines.

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General Agency for U. S. A.—German Manufacturer of acetylene welding and cutting equipment wants to make connections with reliable firm. Address Box 177, care of The Welding Engineer.

Wanted—Experienced Electric Welder, also an Electric and Acetylene Welder. Address Box 178, care of The Welding Engineer.

Wanted—Clean-cut man to sell oxygen and acetylene and to instruct in welding and to demonstrate oxy-acetylene welding equipment. Write Box 179, care of The Welding Engineer, stating fully education, experience and references.

Wanted—Salesmen in every state to demonstrate and sell the most efficient welding fluxes on the market. Liberal commissions. Success guaranteed. R. H. Pierce, 910 Jefferson St., Eugene, Ore.

Position Wanted—By well known man in welding fraternity. Capable of supervising welding and handling experimental work, or can fully organize and manage commercial shop or production department. Will also entertain good sales proposition. Has had years of experience in promoting and developing welding, especially structural. Can furnish record of achievements. Address Box 180, care of The Welding Engineer.

Seamless Steel Tubing
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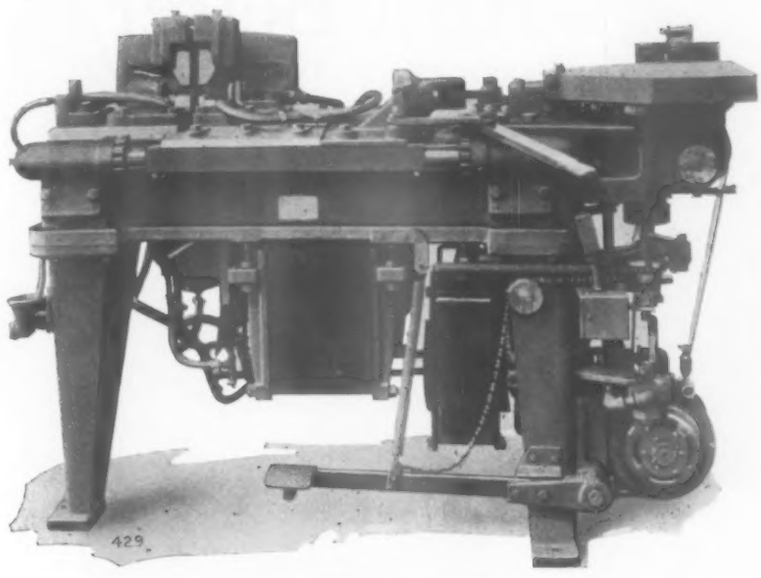
A Federal No. 60 Full Automatic Butt Welder



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In All Principal Cities

Our type No. 60 full automatic gives a production of 300 to 400 welds per hour on above bands and is capable of welding any similar section with the above production.

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Desirable results are obtained by using equipment which is superior in operation—combining the factors of safety, efficiency, economy, dependability and low upkeep expense.

Operators can work at highest speed, consistent with good workmanship using Torchweld without interruptions, delays or failures, insuring increased production and great saving in labor and gas costs.

Evenly balanced gas pressures and patented Torchweld "Non-Flash" Construction Features are responsible for these results.

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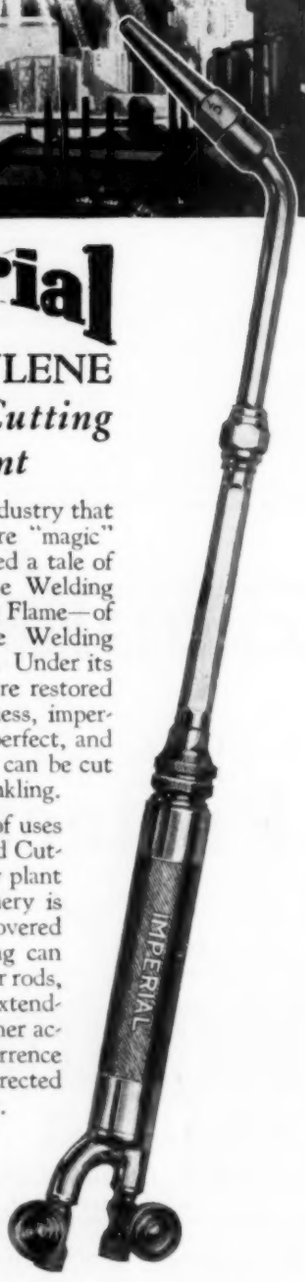
There are hundreds of uses for Imperial Welding and Cutting Equipment in every plant where metal or machinery is used. Blowholes discovered after or during machining can be quickly filled. Shafts or rods, made too short, may be extended. And hundreds of other accidents of frequent occurrence may be economically corrected with Imperial Equipment.

Imperial Oxy-Acetylene Welding is daily finding new uses in production operations where it increases output and cuts costs. Let our engineers suggest the correct type of Imperial Equipment for you.



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For the past 18 years Hackney cylinders have been giving these manufacturers and welding engineers what they wanted — safe, economical handling of acetylene gas.

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A War-Time Cutting Torch That Still Outworks Other Torches

This is the K-G Style "M" Cutting Torch, with Monel metal head and lock nut. Tips can be furnished for use with any cutting gas. K-G tips give greater concentration of preheating flame. Torch can be made any length desired. Standard length, 20 inches.

ANOTHER old-timer in the K-G ranks heard from. A K-G cutting torch was sold to the Newburg Shipbuilding Company during the war. After the armistice, it was sold to a firm who had contracted to cut up old gun boats. That job done, it was bought by a large junk yard, where it put in a few more years of hard service.

Then came a real test. A safe and vault were being dismantled, and none of the torches being used proved equal to the job. Someone suggested a K-G, and this torch was put to work and finished the job without complaint. Its new owner tells us it is not for sale because he never knows when he will have another tough job to do.

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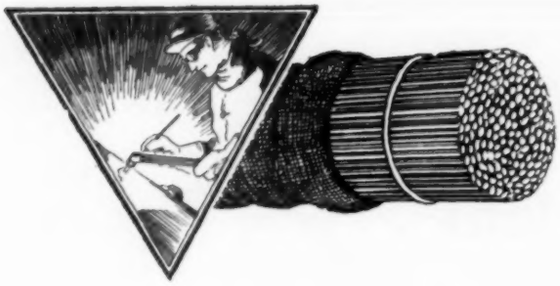
HARRY P. WINSLOW, 35 Vinton St., Worcester, Mass.
WISCONSIN MOTOR PARTS CO., 2354 Cottage Grove Ave., Chicago, Ill.
PASSAIC-BERGEN WELDING WORKS, 650 Main Ave., Clifton, N. J.
SUTTON-GARTEN CO., 217 W. 10th St., Indianapolis, Ind.
E. BRASS AUTO SUPPLY CO., INC., 307 Burnet St., New Brunswick, N. J.
WELDING & SUPPLIES CO., 3445 Parthenais St., Montreal, Canada
CHICAGO GRINDING & MACHINE CO., 2117 Tilden St., Chicago, Ill.
SIGHT FEED GENERATOR CO., W. Alexandria, Ohio.
CHAS. E. EBRIGHT, 2612 Terrace Ave., Columbus, Ohio
FRANK MILLNER COMPANY, 102 N. Olden Ave., Trenton, N. J.
SPRAGUE SERVICE & SUPPLY CO., 276 Davidson Ave., Perth Amboy, N. J.
STORTS WELDING COMPANY, 44 S. Colony St., Meriden, Conn.
WILLIAM McCARTHY, 308 James St., Syracuse, N. Y.
GEO. E. TEMPLE COMPANY, 396 Main St., New Rochelle, N. Y.
JOHN W. EVANS, 95 Brook St., Tompkinsville, S. I.



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They penetrate deeply due to quick melting and free flowing. Being free from impurities no hard spots or pores result. The finished job has the strength of the metals welded—often greater.

Each grade of WISSCO Rods is of special composition for a specific type of welding. All grades are carried in stock to prevent delay in deliveries.

Wickwire Spencer Welding Engineers will prescribe the rod or wire that will do your job better. They will show you how to practice peak economy and insure uniformly good results.

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WISSCO *WELDING RODS*

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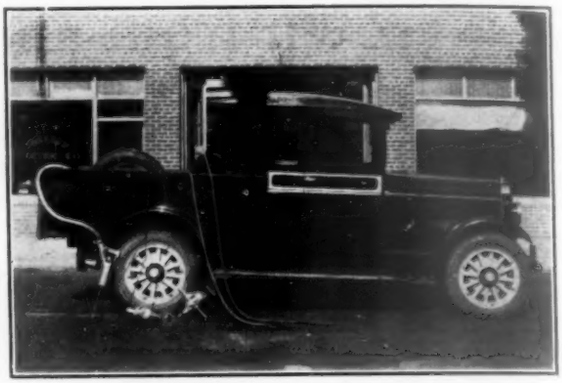
PORTABLE ARC WELDER



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The smooth arc is easily controlled and of great penetration producing a weld that is strong and ductile.

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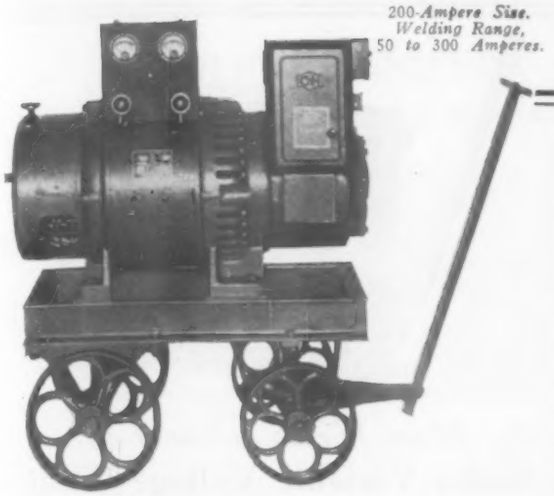

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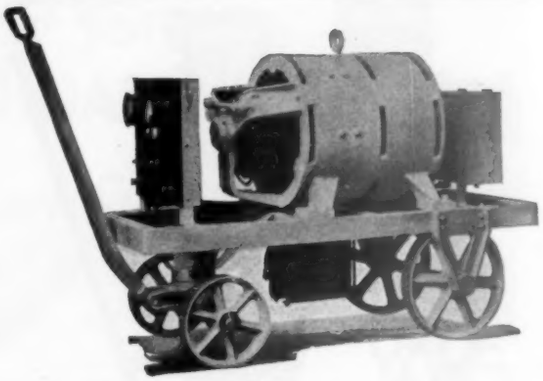

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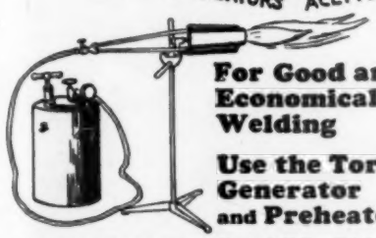

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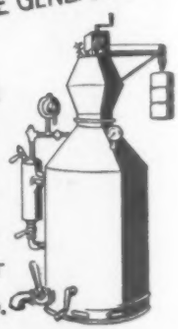

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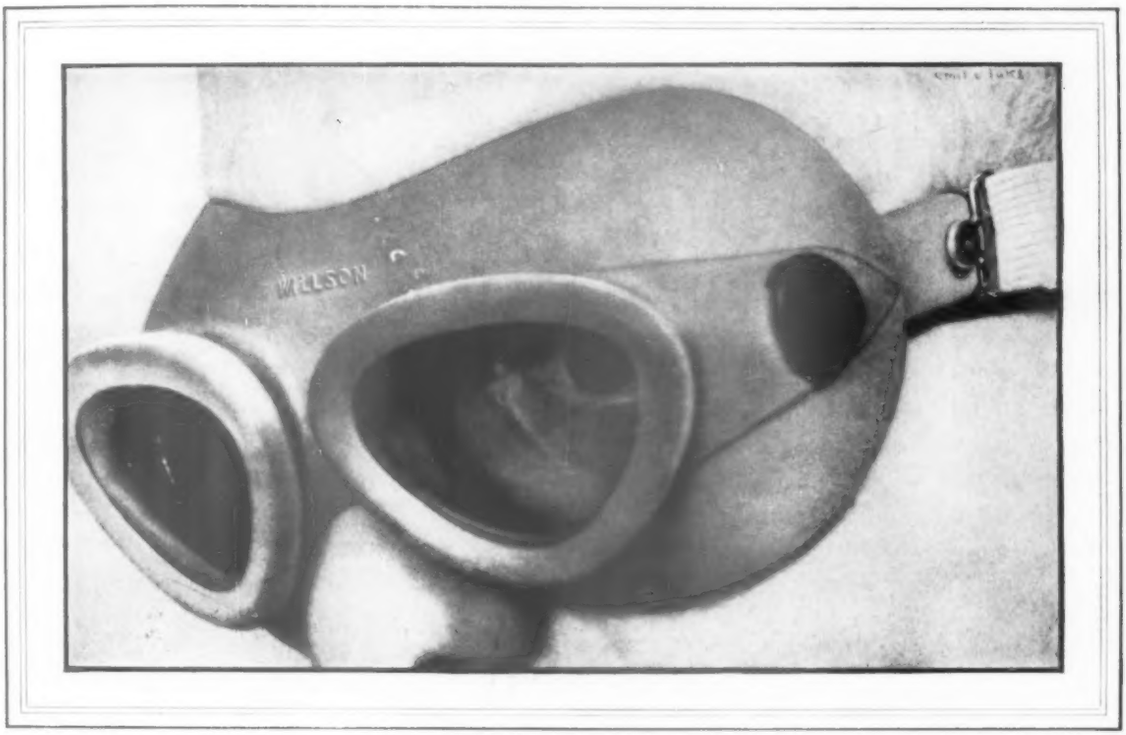

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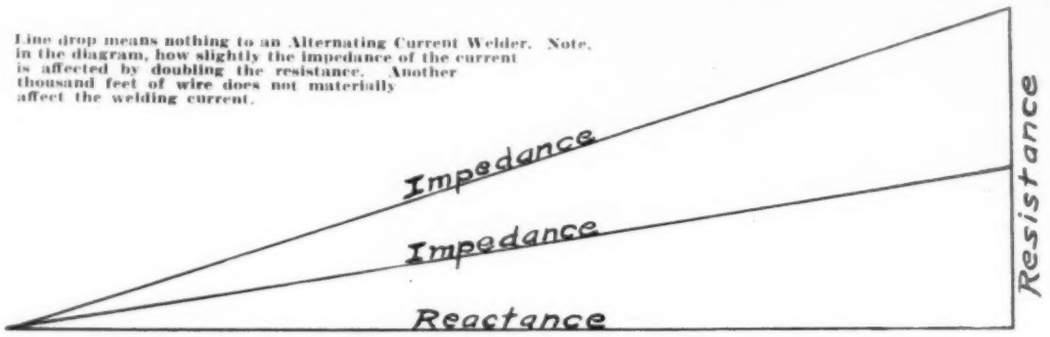

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